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ENGINEERING AND
MINING JOURNAL

METAL AND NON-METALLIC MINING · MILLING · SMELTING · REFINING · MARKETING

McGRAW-HILL PUBLISHING COMPANY, INC. September 28, 1929 TWENTY-FIVE CENTS PER COPY

Motor Trucks at the United Verde Open Pit

By George J. Young

❖

Recent Progress in Quicksilver Metallurgy

By W. G. Adamson

❖

Floating Carbonate and Oxide Manganese Ores

By F. D. DeVaney and J. B. Clemmer

❖

Zinc Cathode Corrosion Apparently Beneficial, by V. I. Zachert

Mining in the Coeur d'Alene District, by A. J. Dunn

Imagine a Race to the Sun!

Relative positions of modern machines, after 15 years

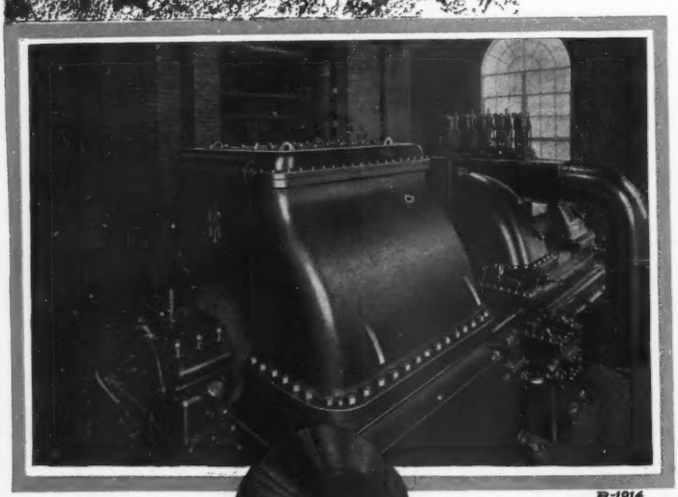
IMPELLER OF I-R TURBO-BLOWER
at 409.1 miles per hour
48,414,436 miles

MAJOR DEBERNARDI'S SEAPLANE
at 318.62 miles per hour
37,707,529 miles

MAJOR SEGRAVE'S CAR
at 231.55 miles per hour
27,403,108 miles

STOCK CAR
at 60 miles per hour
7,100,784 miles

92,830,000 MILES



R-1914

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A consolidation of "Engineering and Mining Journal" and "Mining and Scientific Press"

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To Our Readers:

CONTRIBUTIONS will be welcomed for the section of *Engineering and Mining Journal* dealing with "Cost-Cutting Innovations."

A new feature of underground or surface practice; a novel labor-saving device or safety method; a scheme to simplify a mechanical or metallurgical operation; a short cut to more efficient treatment; a plan to make byproduct manufacture profitable; kinks in accountancy, metallurgical or otherwise—these and others of a similar nature—short and crisp records of progress—will be welcome, especially if illustrated by sketch or photograph.

The mining industries to a large extent owe their success to and depend upon the interchange of ideas such as these. If submitted and found acceptable, *your* idea may be worth $6 to $10—a year's subscription—or even more. Especially if you live outside the United States, this may prove the easiest method of arranging to receive *Engineering and Mining Journal* regularly every week.

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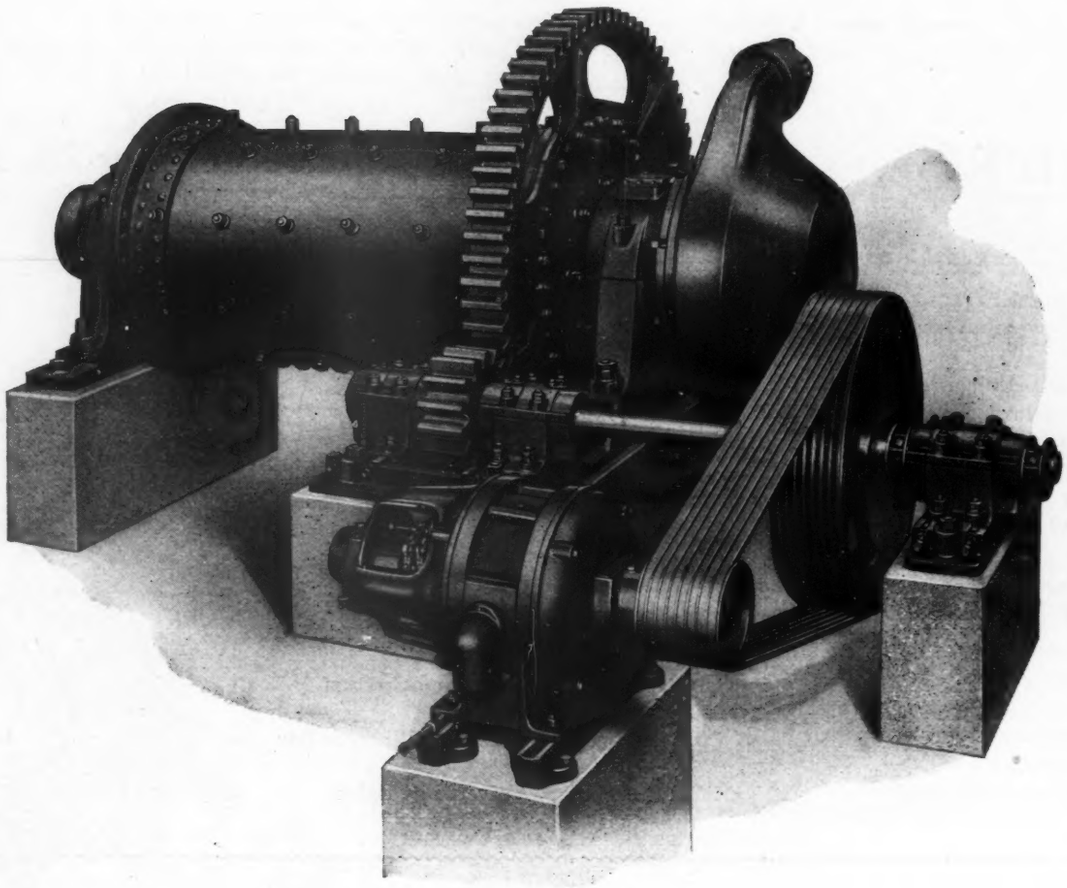

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A Geologist Has His Say on Problems of World Welfare

TO THE layman's eye, the scientist too often appears as one oblivious to the problems and realities of life outside his own particular domain. Of all classes of scientists, the geologist—dealing as he does with things inanimate, almost to the exclusion of all others—is probably most liable to this criticism. A statement from Dr. Alfred C. Lane, well known as a member of that supposedly fossilized profession, indicates that one geologist, however, has been paying serious attention to international affairs and is keenly alive to the necessity for constructive action if world-wide disaster from war and its aftermath is to be avoided.

While at Houghton, Mich., attending the recent meeting of the Lake Superior Mining Institute, Doctor Lane suggested that the United States government establish a fund to promote the welfare of the entire world, using for this purpose the money now being paid to it for debts contracted during the World War. *Engineering and Mining Journal* would like to emphasize, in this connection, that the money would come from the pockets of the people of the United States—the fruit of their labors, economies, efficiencies—not from a supposedly illimitable source of wealth, bestowed by a partial celestial divinity, even as manna, on a grasping individual garbed in striped trousers and a starred tail coat.

World welfare is an intriguing ideal to the man of international mind. The more institutions established for its promotion, the smaller becomes the chance of war and concomitant disaster. The world has long depended on private philanthropy for much of this necessary work. Nationalist aims, and the justifiable hesitation of any one group of taxpayers to assume responsibilities that the citizens of other countries will not share, are obstacles to governmental backing for world-wide projects.

But the field available for the work is enormous. The activities of the Red Cross in humanitarian relief, of the Rockefeller Foundation in preventive medicine, and of the Carnegie Foundation in aiding navigation—all these offer evidence of what can be done. Furtherance of international welfare with the money the United States will obtain for payment of war debts would certainly be a more fitting use than the purchase of additional armaments and the salarying of larger numbers of military and naval officers. It would be a friendly gesture, the effect of which would not be lost on European nations that at present are not too cordially disposed toward their colossal young rival across the Atlantic.

Doctor Lane's suggestion, or any similar one, may not be adopted; but the willingness of men of his type to take a stand on the question, and to stick to that stand in public, is a good sign. If more can be induced to follow, something may result, and the world will have taken a constructive step in the direction of peace.

E.&M.J. Is Primarily a Technical Magazine

REPEATED requests come for more comprehensive information in our columns on stock-market variations. We are anxious to please, but the time has come when plain speaking is necessary. *Engineering and Mining Journal* is not a financial paper. To lean too heavily in this direction, especially in an attempt to record the fluctuations of stocks and shares, would seriously jeopardize the service expected by the great majority of readers—a service that has for its purpose the progress of the industry by the dissemination of useful information leading to improvement in technical results.

The income that enables *Engineering and Mining Journal* to fulfill its mission to the profession and industry of mining engineers comes largely from the advertisers of equipment and methods needed to achieve such technical improvements and better economic results. The magazine differs from many other publications, to which our attention is frequently drawn, by reason of the fact that it carries no advertising from dealers and brokers in stocks and shares. We realize the necessity for financial exchanges and all that goes with them, but we do not seek income in that direction. It is not in our field.

To follow stock-market fluctuations closely and to

emphasize information that directly causes such fluctuations is to make the magazine more acceptable to those who subscribe merely for such data and, by so doing, seriously imperil the proper functioning of a medium for the dissemination of technical information, a medium the purpose of which is to be helpful to the operator in mine and mill and smelter, not to the operator on the stock market.

The Nicaraguan Canal and International Goodwill

"A PICKED engineering battalion numbering 400 officers and men today was ordered by Secretary Good to duty in the Central American jungle to survey the route of the proposed $1,000,000,000 canal." So runs an Associated Press dispatch from Washington under date of September 5.

By the Hay-Pauncefote treaty of 1901, the United States agreed that the Panama Canal should be open to all nations of the world on equal terms. Congress considered the document as a "scrap of paper" in 1911, when the Panama Canal Act was passed, which provided for exemption from tolls for American intercoastal shipping—a violation that was corrected by President Wilson in 1914, who repealed the Act.

Assume the construction of the new Nicaraguan canal. Toll rates may be adjusted and probably will be adjusted to favor American shipping: the various treaties refer to "the canal," subsequently known as the Panama Canal, not to "the canal or canals." American shipping will therefore patronize the Nicaraguan route.

The Panama Canal will still be available "for the use of all nations on equal terms." But if Congress, acting with the same irresponsible spirit that led to the passage of the Panama Canal Act of 1911, decides to raise the tolls above those levied for American shipping using the Nicaraguan canal, the letter of the Hay-Pauncefote treaty will still be observed, but an interesting international situation will develop. It is not too early to consider the effects of such an eventuality.

Valuable Byproduct Is Made from Smelter Waste

MINERAL wool, also known as silicate cotton and slag wool, is now being made from the slag discarded from the lead refinery plant of the American Smelting & Refining Company at Alton, Illinois. Reports state that the present daily output of 50 tons is likely to be increased as the new product becomes more widely known. It is marketed as loose "wool," as a blanket material, as board or brick. One of the most significant of the developments resulting from this enterprise is the delivery, by compressed air, of the wool into wall spaces and between joists in existing buildings.

This industry should have been established long since. The value of blown slag as an insulator has been well known for many years, and one metallurgist, Mr. Herbert Lang, has at least been generous enough to publish the results of his researches and experiences in the development of an economical and efficient technique of manufacture.

Those who are interested in profiting from smelter byproducts should realize that all slags will not make good wool. A slag that is rich in iron will blow into shot; one that is high in the alkaline earths will merely form a dust. A long fibre is desirable, necessitating a lengthy period of elasticity, with a wide temperature margin between softening and complete fluidity.

An "Alloy Age" Looks to the Mining Industry for Raw Materials

THAT an "Alloy Age" is soon to replace a fading era of ordinary iron and steel was apparent at the National Metals Congress, held recently at Cleveland. This trend of events is being foreshadowed by the unprecedented current demand for alloys, which in turn owes its origin to the progress made in the manufacture of automatic mechanical equipment and similar devices of this machine age.

High-speed cutting alloys, corrosion-resistant steels and irons, light-weight alloys of high tensile strength, die-casting alloys, and alloy welding rods, particularly, are being more widely applied today than ever before. Tungsten, chromium, nickel, cobalt, vanadium, and manganese are the chief metals involved in producing the numerous alloy steels and irons; nickel, copper, manganese, and silicon are being used to make the light-weight aluminum and magnesium alloys, which have greater tensile strength than the best steels of a few years ago.

No single group of alloys is, at the moment, attracting more attention than the high-strength light-weight alloys of aluminum and magnesium, which have made possible the all-metal airplane and dirigible, the light-weight motor coach and railroad car, and light-weight structural frames for many other purposes, where strength is also a requirement of the structural material. These alloys contain, in addition to the aluminum and magnesium, from 2 to 5 per cent copper, a small amount of manganese, and sometimes silicon. Eventually, however, the light-weight metal beryllium is expected to take front rank in the manufacture of these alloys. As the price of the metal decreases with the probable growth in the supply available, the production of beryllium alloys will unquestionably expand rapidly.

The use of zinc-base alloys for die-casting purposes has increased fivefold in the last seven years, and, contrary to popular opinion, these alloys have high tensile strength. The ease with which they are cast into intricate shapes and fine threads, combined with the excellent surface they offer for many finishes, makes them suitable for a great variety of equipment parts.

The aforesaid facts, in addition to others discussed at the congress, have particular significance for the mining industry, to which the manufacturer of alloys must look for his raw material. As the "Alloy Age" develops

and grows out of its swaddling clothes, many of the nonferrous metals will undoubtedly be employed in large quantities for the manufacture of alloys. For this reason, chiefly, the mining industry can well afford to encourage the utilization of alloys and to indorse wholeheartedly the efforts of metallurgical research workers in their quest for new alloys of superior qualities.

Opportunities for Speculation in Alaskan Mining

MORE in sorrow than in anger does *Engineering and Mining Journal* criticize a pamphlet entitled "Blazing the Trail to Millions," issued by the MacDougall Consolidated Mines Company, of Alaska. The account of what this company will do in the immediate future is pregnant with promise of vast return to those who invest.

The president and general manager of the company is Angus M. MacDougall. "One of the most interesting examples," we read, "of the value of his scientific geological knowledge, coupled with many years of practical experience, was his acceptance of responsibility for the Copper Queen copper-silver-gold mine after eleven other geologists and mining engineers had rejected it. Within six years MacDougall's judgment had been rewarded by a production record of $28,700,000 from the mine."

The MacDougall company has been organized, the brochure states, for the purpose of owning and developing various properties and concessions in the Fairbanks region in the Tanana River valley of Alaska. A 100-ton amalgamation mill is expected to be in operation at the lode claims "within eighteen months," the unit being duplicated until six or eight are in operation. "It is estimated that there are at least 5,000,000 tons of ore above the tunnel level and an estimated tonnage of 24,900,000 tons below the tunnel level. Assays and tests of this ore have shown values from $15 to $50,000 per ton—but all calculations," one is assured, "have been based on an absolute minimum—$15 per ton ore." The placer claims, the report states, "will yield $18,000,000 in gold, about $13,000,000 of which will be clear profit after all costs of mining have been deducted."

A naïve reference to the sponsor of the enterprise discloses the technical program. "Let Angus MacDougall, himself, tell you how the work will progress:

" 'We will start development work at Shaft No. 1 on or about November 1, 1929. We will average six feet per day in shaft sinking, and by April 30, 1930, we will have sunk the shaft to the 600-ft. level, and we will have done 2,000 lineal feet of development work with tunnels, drifts, crosscuts, and raises during the last 75 per cent of the shaft sinking. This work will be carried on from the 200-ft. level to the 600-ft. level. By April 30, 1931, we expect to have 46,153 tons of gold ore blocked out, ready for mining and milling, with a minimum average gold value of $50 per ton—a gross value of $2,307,650.

" 'As this ore is being mined and milled we will continue on with the shaft sinking and with the development of the ore. We expect to sink the shaft to the 6,000-ft. level. I believe we will find 24,900,000 tons of $15 ore between the surface and the 6,000-ft. level, with a total gold content and value of $373,000,000. I have reasons to believe this.' "

Prospective investors should seek the technical reasons that have engendered so positive a belief. Despite the strength of opinion held by the promoter, however, the narrator hints that caution would not be out of place, averring that "Angus MacDougall, practical geologist and mining engineer that he is, would be the last one to state that any mining project was without its element of chance." Even the 46,153 tons of $50 ore expected by April 30, 1931, may not all materialize!

The prospectus is unique in that it contains an "approximate potential valuation of resources, subject to final appraisal," totaling $93,705,000 for orebodies and claims, millsites and improvements, and a tunnel site, which total is in conflict with the belief that the lode mine above will disclose ore to the value of $373,000,000. The irresponsible character of the prospectus, however, is best illustrated by the statement, in regard to gold, that "The present price of $20.67 per ounce will probably be doubled and perhaps trebled within a few years."

For Large-Scale Profits Make Small-Scale Mistakes

THE history of the mining and allied industries is replete with examples of large-scale blunders, which have proved costly to the investor. As a result, the element of risk is magnified, and capital is induced to flow in other directions.

In some quarters a quaint impression prevails—that the public must first be hypnotized by fulsome promises and awed by an exhibition of gigantic plans before capital can be made available. True, much can be done while the patient is under the influence of statistics; but unless the premises are sound, the day of reckoning cannot be postponed indefinitely.

Blunders may be classified as of two types. Perpetration of those of the first type forms a part of all normal educational processes. The outcome leads to discarding the undesirable and prefering what is best, based on knowledge gained by experience. Even the wise man will make mistakes.

Blunders of the second type are in the habit-forming class. Their authors stick to them, repeat them, piling an edifice of technical inadequacy and economic insecurity on weak foundations. Instead of making correction at the source of the trouble, an elaborate research program is sometimes started, to find more work of a kind congenial to the adventurer into a field for which he is not equipped. Many an invention has served to camouflage the fact that a blunder was made that was allowed to persist and so deform the technical structure. The cost of the correction could have been avoided by making a fresh start.

Prospective profits from technical operations are put in jeopardy when reputations have to be preserved by inventive whitewashing. Some of the ill-effects are due to insufficient and inadequate small-scale experimentation and pilot-plant operation. Secretiveness as to technical details, especially when accompanied by propaganda that pretends a success that has not been achieved, is invariably an indication of the triumph of finance over facts.

MOTOR-TRUCK

Proved Mobile and

Four Bucyrus electric power shovels are employed for loading the ore

By GEORGE J. YOUNG

View of pit mine of United Verde Copper, at Jerome, Ariz., which is in a persistent fire zone

OPEN-PIT MINING at the United Verde copper mine, Jerome, Ariz., has progressed to a bench level below the 300 level of the mine. Bench heights are about 30 ft. The pit is shaped like an ellipse, the orebody following the main axis. About 6,000,000 tons of material was removed in the preliminary stripping, since which time the quarry operations have been in both ore and waste rock. Present output is about 90,000 tons of ore per month and from 100,000 to 105,000 tons of waste rock, or about 6,000 tons per day. Three shifts are worked, floodlights being used to illuminate the pit at night.

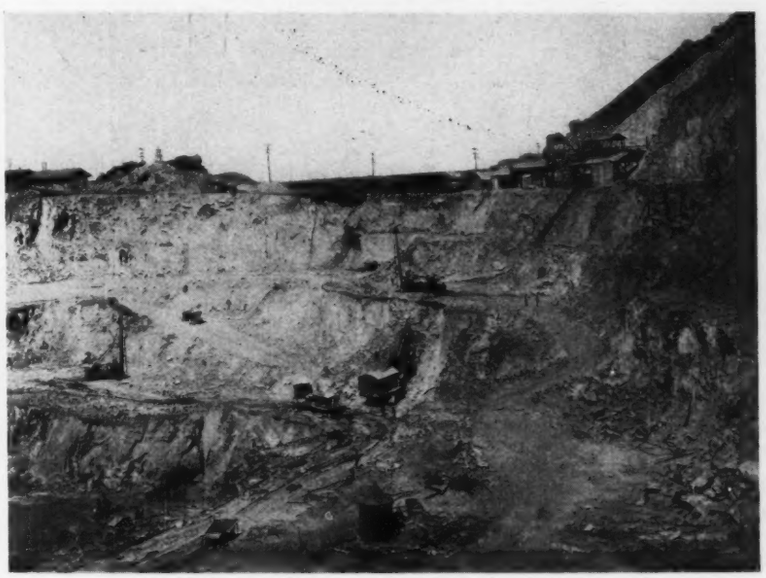
The exposure of a large orebody such as the United Verde by open-pit workings is of interest, but the richest ore was previously mined, and filled stopes were left in its place, and also part of the remaining ore was in a fire zone, as well as in the oxidized zone, so that a condition exists which disturbs the picture somewhat. The impression given is of a series of more or less irregular strands of different colors which mark the locus of the orebody, but which do not give it its normal appearance as in other open pits. However, the general impression is that the orebody is complex in structure, varying in both metal content and chemical composition. As a result the demand upon the engineering staff to meet the conditions imposed by the mill and smelter with respect to uniformity of grade and chemical composition is severe and necessitates frequent sampling and shifting about of the excavating equipment. Sampling maps give the general key to this situation and frequent face samples enable rapid decisions to be made. The important point is that the open-pit work is not merely excavation, but is selective mining refined to as great a degree as possible. Four general classes are made: mill ore, smelter ore, leaching-pile ore, and waste rock. Smelter ore is divided into two additional classes, siliceous ore and basic ore. As no bedding is practiced at the smelter, the exigencies of the situation imply close co-ordination of mining operations with the needs of both smelter and mill. To accomplish this end the mining units must have a high degree of mobility and the control of mining is exacting.

Drilling falls into two classes, churn-drill holes and block-and-toe holing. Armstrong electric churn drills are used for drilling for primary blasting. Bit diameters are $5\frac{7}{8}$ in., a 6-in. pipe being used for collaring. Holes are 35 ft. in depth, giving a bench height of about 30 to 32 ft. A burden of about 10 ft. is placed upon the holes. Hand-held drills are used for block-holing. An unusual condition prevails in parts of the

TRANSPORTATION

Efficient at Open-Pit Mine in Arizona

Progress at the property of the United Verde Copper Company, at Jerome, Ariz. . . . Complex orebody necessitates adequate provision to secure uniformity of ore to mill and smelter . . . Churn-drill methods . . . Blasting practice . . . Combating the fire hazard . . . Electric power shovels are used . . . Mining methods described . . . "Caterpillar" haulage



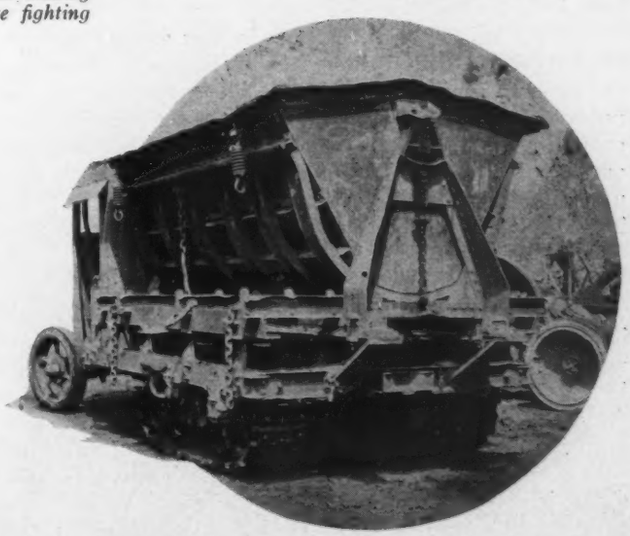
Overlooking the pit, upper right, is the plant making slime pulp, for fire fighting

pit, and this has been brought about by the presence of hot rocks resulting from previous mine fires. The low conductivity of rock and ore results in the retention of heat for long-time periods. The highest temperature measured was 780 deg. F. Special caution and methods are required to use explosives under these unusual conditions. The practical details of this work were given to me by E. M. J. Alenius, who is engineer under J. C. Perkins, superintendent of pit operation. They are as follows:

A 6-in. churn-drill hole was selected because it can be loaded with a larger amount of explosives and more quickly than holes of smaller diameter. The larger hole admits of more thorough examination at the bottom of the hole as to whether heat is being given off by the rock around the hole, or being drawn into the hole from a distant source through existing creeks, fissures, and crevices which occur in the rock structure. A temperature of 120 deg. F. or less is safe for loading and tamping a hole, using ordinary methods. If we can cool a hole so that it will remain below 120 deg. F. for a sufficient time to permit loading and tamping, the ordinary means are used. If the rock around the hole conatins heat, it is difficult to cool. However, in holes where heat is being drawn into the hole, we have been able to cool them down by the use of water and sand. All holes are chambered to hold the required amount of charge except those in excessively hot ground, which are loaded by torpedoes.

Under some conditions where the hole is not very hot, it has been cooled by merely running water through it for a period of from an hour to 24 hours. The powder foreman, Henry Davis, has found that by putting sand into the bottom of the chamber, he has been able to cool holes down from a temperature of 212 deg. to below 120 deg. F. for a sufficient period to allow loading and firing. The hole must be chambered in this case, so as to hold sand and explosive. As much as three wheelbarrows of sand have been placed in some of our hot holes. When the sand is first put into the holes a small amount of water is also run in, which washes the sand into the openings and fills them up. The hot gases being drawn into the hole are thus sealed off. Moreover, sand is a poor conductor of heat and the cool sand does not become

Six Linn tractor trucks are used for transporting ore from the pit during wet-weather conditions.



heated readily. We have been successful in cooling most of our hot holes by the use of sand.

For holes which we are unable to cool down, a torpedo is used for blasting. The torpedo is lowered into the hole very quickly, and as a consequence no tamping is used. The charge in the torpedo is connected up with the blasting line before lowering, so that it can be detonated as soon as the men are in the clear. For all of our blasting we use an 8X blasting cap connected with a 440-volt power line. Generally 35 per cent gelatin is used in torpedoes. A small amount of Quarry Special No. 1 manufactured by Apache Powder Company has been used. However, when granulated powder is used additional care is necessary to prevent the powder from leaking out of the torpedo.

deg. F.; smokes at 350 deg. F.; darkens at 500 deg. F.; chars at 550 deg. F.; glows at 600 deg. F.

Cardboard tubes, 4½-in. inside diameter, have been tried for the 6-in. holes. Metal tubes, lined with asbestos and closed with a wooden plate in which the lowering cord has been passed through a hole and knotted, have been successfully used.

In the hottest ground not more than one 6-in. hole is shot at a time. In cooler ground groups of three holes have been shot. In loading some of the 6-in. holes a wooden trough was constructed about 6 ft. in length so that the torpedo could be pushed into the hole without the necessity of having men directly above the hole. Ordinarily two men lift the torpedo and carefully lower it into the hole.

Torpedoes ready for charging into the churn-drill holes

The highest temperature measured in any hole was 780 deg. F. In fact the material blasted would often burst into flames when the dipper was run through it. We have been very careful in the measurement of temperatures and use for this purpose a Leeds & Northrup No. 6637-C potentiometer equipped with a thermocouple especially for the purpose.

For the smaller air-drill holes in hot ground we use ordinary cardboard mailing tube, 1-in. inside diameter, of various lengths for making the torpedoes. It is necessary to space the holes closer when shooting hot ground with torpedoes, so as to insure the required amount of explosive. We have not been able to get much hole depth in hot ground—seldom more than 8 ft. These air-drill holes are used for breaking a hard toe.

Special Cardboard Blasting Tubes Used

The cardboard tubes are cut to the length desired before being loaded, and then loaded, primed, connected up with the blasting line, and laid on the ground in front of the holes until the blasting signal is given. As many as twenty of these torpedoes have been connected together, one man being assigned to three or four torpedoes, which he places in the holes when the signal is given. An ignition test on one of these tubes gave the following results: Begins to volatilize at 300

Hot ground has also been excavated in some of the coyote blasts. In one pocket of the first blast the rock temperature was 152 deg. F. In this instance the walls of the pocket were coated with gunite and lined with asbestos. The pocket was loaded with 24,000 lb. of black powder and 2,000 lb. of 50 per cent gelatin. The blast was fired four days after loading. This is not considered safe practice and will not be attempted again.

Mechanical Equipment

Major mechanical euipment consists of four churn drills of the Armstrong electric type; four 50-B Bucyrus electric power shovels; 12 six-wheel Moreland trucks, four-wheel drive, and six Linn tractor trucks. Auxiliary equipment consists of a 3½-ton tool truck with acetylene welding outfit; a two-ton truck for hauling men and supplies; a five-ton truck for handling drill steel; a one-ton truck for general service; a P. & H. crane mounted on a five-ton truck and provided with a clamshell bucket, and a power road grader. An Armstrong bit dresser is used in the shop for preparing churn drills.

Churn drills are operated in two shifts per day and drill crews are paid a bonus for footage drilled in excess of standard. Some of the standards established in feet drilled per hour are as follows: Siliceous sulphide, ¾; massive sulphide, 1; hard sulphide, 2; soft

A power grader operated by a gasoline truck body

sulphide, 3; hard porphyry, 1½; soft porphyry, 3; hard diorite, 1½; altered diorite, 3; quartz, 2½; oxide and stope fill, 3½; and bedded sedimentaries, 4. During the period from January to April, inclusive, 10,372 ft. was drilled in 366.75 drill shifts, or an average of 28.31 ft. per drill shift. Mr. Perkins stated that the electric churn drill has been operated at a power cost equal to 30 per cent of the coal cost on steam drills. A Presser swivel and wire-rope line have kept repair costs low. The power drill sharpener turns out twelve bits per day and is an important factor in maintaining a good drill steel supply.

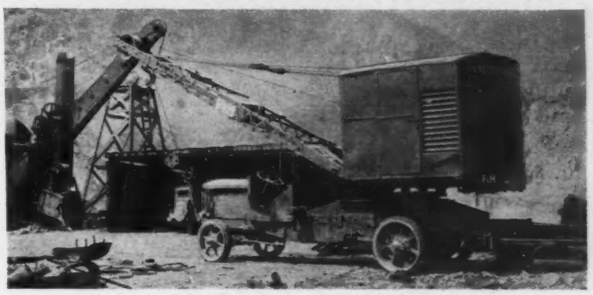
Electric power shovels are operated on three shifts per day. During April, 1928, the number of eight-hour shifts was 215.4, the tons per shift, 870.3; and the power consumption, 1.208 kw.-hr. per cubic yard, or about 0.55 kw.-hr. per ton. During the same month trucks were operated 669.4 shifts, handling 128.5 cu.yd. per shift and consuming 14.7 gal. per shift or a ratio of 8.75 cu.yd. per gallon of gasoline. About 3.1 truck shifts was required for one shovel shift. In the same month 613 machine-drill shifts were used for both blockholing and mounted drills. During this month 85,999 cu.yd. was loaded by shovels, 1,630 cu.yd. by crane, and 2,596 cu.yd. by glory-hole operations, or a total of 90,225 cu.yd. Total operating days were 29; total man-shifts, 6,290; and cubic yards per man-shift were 14.34, or 30.8 tons. Total explosives used were 41,000 lb., or 0.45 lb. per cubic yard.

Six or more active transfers are maintained, all discharging upon grizzlies and thence into loading out pockets on the Hopewell tunnel level. Clogging of transfers is prevented by not allowing any pieces that will not pass the shovel dipper to get into the transfers. The chief difficulty arises from the cementing action of the finer material. To avoid this difficulty, coarse and fine material are mixed when loading.

Transfer raises are usually accessible on each mine level and are sealed off by doors and bulkheads from the mine workings. When a transfer becomes clogged all dumping into it is stopped and it is inspected on various levels. Clogged material is loosened by blasting or in some instances by allowing a small amount of water to run down the transfer.

Three principal blasting stations are maintained in the pit, and safety shelters are provided at other points. Two important difficulties have arisen in pit operation, one from the gases arising from burning ore and the other from the dusty nature of the partially roasted ore. At one time it was necessary to take active measures to seal off the porous rock masses from which sulphur gases arose. This was done by flooding them with slime. The slime blanket proved effective.

Tool Truck (3½-ton), with acetylene welding plant



A P. & H. power crane is mounted on a 5-ton truck

The dust nuisance has been partly ameliorated by providing respirators and goggles for the men who have to work under adverse dust conditions. Some of the men use a flat sponge and handkerchief tied over the lower part of their faces. Others use an aluminum respirator with a "filter" pack. Laminated goggles are used, and shovel operators who work where gas and dust are in quantity wear special rubber mounted goggles which protect the eyes from irritating gases.

The United Verde open pit is unique in mining practice, as it was planned by a far-seeing management to overcome the necessity of underground mining in a persistent fire zone. The physical situation was not favorable to open-pit operations. A large proportion of overburden had to be moved. However, much of the preliminary work has been done, and active ore mining is in progress. The present pit is 1,200 ft. on the north and south axis and 850 ft. on the east and west axis. It is backed by high walls on the south, west and north and opens to the east. It is now about 170 ft. below the 160 level, which is the service level for the pit. Plans contemplate working down to the 700 level, or 540 ft. below the present service level. At the 500 level the ore area is about 4½ acres in extent. A looped roadway, 40 ft. in width, turns of 22 ft. radius, and 10 per cent grade, with maximum grades of 15 per cent in places, gives access to the benches from the service level. This roadway is on the east side of the pit. The plan to resort to glory-hole mining after attaining a certain depth has been abandoned and bench mining will be followed. A rough estimate indicates

3,000,000 cu.yd. yet to be removed, and at the present rate of production five years, according to a recent estimate, will be required to mine out to the 500 level.

One of the novel features of operation is the absence of all tracks in the pit. Motor-truck transportation has proved mobile and efficient. Distances from shovels to transfers are short. A side-dumping truck of 7½ to 10½-ton capacity (3½ cu.yd. water-level volume) has been adopted. Difficulty was experienced in operating the six-wheel trucks during the winter months, on account of poor traction in mud and snow. A Linn truck with caterpillar tractor was tried out and proved suitable for the adverse conditions.

Protection of the pit from storm waters is provided by a series of ditches cut in the cliffs of the south side of the pit. A concrete dam with overflow drains catches the water on the southwest and west and by underground connections leads it to drainage outlets.

Sales of Selenium Increase, but Demand for Tellurium Remains Small

By S. Skowronski
Research Engineer, Raritan Copper Works
Anaconda Copper Mining Company

COMMERCIAL PRODUCTION of selenium and tellurium has from the beginning of the production of these metals been connected with the electrolytic refining of copper. Recovery is usually made from the alkaline slags obtained during the refining of the slime and from the condensed selenium oxide (selenium whiskers) obtained from the flue system of the Doré furnaces.

Prior to 1916 the commercial demand for selenium was small, but since then the development has been rapid and the yearly sales of selenium show a remarkable increase. The commercial demand for tellurium, however, remains small, the yearly sales being only 1,000 lb. Selenium sales statistics, as compiled by the U. S. Bureau of Mines, follow:

Sales and Value of Selenium 1917-1927

Year	Pounds	Value	Average Price per Pound
1917	39,630	$70,000	$1.77
1918	103,694	206,540	1.99
1919	60,025	125,966	2.10
1920	92,141	175,508	1.90
1921	55,978	89,148	1.59
1922	123,565	177,542	1.44
1923	127,174	237,196	1.86
1924	153,762	286,066	1.86
1925	194,007	330,637	1.70
1926	252,312	438,132	1.74
1927	284,508	491,996	1.73

The chief use for selenium is in the glass industry, where it is employed both as a decolorizer and in the manufacture of ruby glass. During the World War, the embargo on the use of high-grade manganese dioxide for the decolorizing of glass led the glass manufacturers to substitute selenium, and the large amount of selenium used for this purpose accounts for the rapid increase in the sales of that metal. The ceramic industry uses selenium in conjunction with cadmium sulphide to obtain various red and orange shades of enamel. Of late years, selenium has been used with success in rubber compounding, increasing the resistance to abrasion of the rubber by 50 to 80 per cent. Wire cable sheathed with selenium rubber is on the market and is advertised as such. Other uses of selenium rubber, such as in tires and mechanical rubber goods, are still in the experimental stage. Selenium will act as a flame-proofing material in cable, not only when applied to the surface, but also when compounded with rubber to the extent of 8 per cent. Some selenium is now used in the dye industry for the manufacture of special dyes.

With the development of television, selenium cells have been improved considerably, and the lack of uniformity and high inertia of the earlier types of cells have been corrected. Several makes of selenium cells are on the market today that are guaranteed to give satisfactory service. For the glass, ceramic, rubber, and dye industry, selenium, pulverized to pass an 80-mesh screen and analyzing not less than 99 per cent of selenium, is usually specified. For cell purposes, the remelted selenium, cast either in stick or cake form, is recommended.

Tellurium was one of the first anti-knock compounds to be added to gasoline; it proved to be effective and efficient, but the potential demand was so much greater than the visible supply that the use of tellurium for this purpose had to be abandoned.

During 1922, more than 1,000 lb. of metallic tellurium was sold to radio manufacturers for the manufacture of crystal detectors, but the rapid advance in the technology of radio tubes quickly stopped the use of tellurium for this purpose. Electroplaters are using a solution of tellurium chloride as a dip for silverware when a dark finish is wanted.

Owing to the similarity in the physical appearance of tellurium to antimony and bismuth, many experiments have been made to alloy tellurium with other metals, but, because of the ease with which tellurium forms tellurides with all the metals, the experiments have all been failures.

Tellurium may be refined electrolytically by using a hydrofluoric acid electrolyte; Prof. F. C. Mathers has produced some remarkably thick and smooth electro deposits of tellurium by this method. Commercial metallic tellurium is made by reducing tellurium oxide with carbon, or by dissolving the oxide in acid and precipitating the metal from the solution by sulphur dioxide gas. Tellurium is usually sold in one-, five-, or ten-pound cakes, analyzing 98 to 99 per cent tellurium, the chief impurity being selenium. Tellurium is also furnished in powdered form when desired. Two grades of tellurium oxide are on the market, one chemically pure and the other containing small percentages of selenium and sodium salts.

Recent Progress in the *Metallurgy of Quicksilver*

By W. G. ADAMSON
General Manager, Pershing Quicksilver Company, Lovelock, Nev.

The Pershing Quicksilver property from a near-by vantage point

THE mine and plant of the Pershing Quicksilver Company are situated 23 miles by road east of Lovelock, Pershing County, Nev., in the Relief mining district, the company being the first to start operations in this active quicksilver region. The company's holdings consist of eight lode mining claims, 160 acres of patented mineral land, and 160 acres of ground held under placer locations, the first two mentioned covering a distance of 7,000 ft. along the prominent lode in which the ore occurs.

A portion of the ground was first optioned in 1912, and a retort plant erected, from which more than 200 flasks of quicksilver were produced. Operations were then discontinued and not resumed until a consolidation was effected in 1926, when the ground was taken over by the present operating company. Within a year after starting intensive development work, sufficient ore had been blocked out to justify the installation of a Diesel power plant and a 4x60-ft. rotary calcining furnace, which was completed in February, 1928.

After starting the plant, trouble was caused by excessive dust passing through the type of baffle dust arresters that had been installed, and within three months these were replaced by two Rees "cyclones," which have been remarkably successful in eliminating the dust from the condensing system. In July, 1928, ore reserves having been considerably increased, the company began the installation of an eight-hearth Nichols Herreshoff roasting furnace to treat the finer ore and increase nearly fourfold the total tonnage which the plant had been capable of treating. During the shutdown a five-ton calcine bin was installed under the firebox end of the rotary furnace. Erection and testing of the enlarged plant was completed in January of this year.

The ore occurs in a prominent sedimentary fault escarpment which runs southeast and northwest for over two miles in length at the extreme end of, and at right angles to, the East Humboldt range of mountains. The limestone of the formation is probably early Jurassic and is intermixed with shale and sandstone beds of varying thickness. Cutting through and roughly paralleling the escarpment are two distinct intrusions. One, intimately associated with the ore, is a diabase, variable in width but traceable by several surface outcrops and the underground workings for over a mile in length along the lode. In places this dike is so thoroughly altered by hydrothermal action as to defy identification, except through characteristic relic crystalline structures visible in thin sections under the microscope. Several hundred feet away in the footwall is a lamprophyre dike, the presence of which seems to have little to do with the genesis of the ore.

The ore is a replacement of a siliceous lime and a black sandstone which underlie a strong sulphidized shale bed dipping about 70 deg. from the horizontal. The orebodies are not confined within definite walls, but occur in fairly continuous lenses, the boundaries of which are determined by the lowest economic limit at which the ore can be profitably mined. A tremendous fault fissure, in places over 10 ft. wide, parallels the dike and ore, and the confinement of the largest lenses to within 40 ft. of this break indicates its probable rôle in the genesis of the ore. The richest lenses occur at the intersection of the northeast and southwest cross-fractures, which cut the lode at frequent intervals, with the main fissuring. The principal ore mineral is cinnabar, the red sulphide of mercury, and with the exception of a few places near the surface it occurs as the crystalline variety.

Almost all of the development has been carried on in one of four similar hills along the lode, ore being blocked out on three tunnel levels for a distance of 1,200 ft. Up to the present, with the exception of ore from exploratory winzes, all ore mined has come from above the main haulage level, the average distance to the surface from this level being 165 ft. Two 75-ft. exploratory winzes have been sunk from this level that show the vein to continue to that depth, at least. Exploratory and development work has recently been started on the two similar hills to the southeast. This work shows the ore and geologic conditions to be about the same in Hill No. 2, whereas in Hill No. 3, which is farther to the southeast, the vein appears to be narrower, but the ore is of a higher average grade. A drift opposite the portal of the main haulage tunnel has just been started to explore the downward extension of a uniform outcrop in the fourth hill to the northwest. A

Power house and furnace buildings of the Pershing Quicksilver Company

two-compartment shaft to be situated just above the furnace plant is planned for the near future.

In mining, the ore is blocked out by raises and cross-cuts run at 50-ft. intervals. A modified shrinkage system of mining is employed, the stopes varying from 6 to 40 ft. in width, the average being from 14 to 16 ft. The ore is drilled readily and breaks well, with the result that little timber is required for support.

The power plant is housed in a 40x50-ft. fabricated steel building and consists of an 80-hp. Fairbanks-Morse Diesel engine, belt-connected to a 65-kw. alternator, and a 120-hp. Diesel engine direct-connected to a 650-cu.ft. Sullivan angle-compound air compressor. Electric current is now also being obtained from the Nevada Valleys Power Company. The blacksmith shop is partitioned off in the same building. An engineer is required on each shift, and all the blacksmithing is done on the day shift by one man.

The reduction plant is housed in a 50x96-ft. fabricated steel building adjoined in the rear by a 275-ton wooden ore bin that is connected to a small trestle across which cars are brought direct from the haulage tunnel. The ore is first crushed to 1½ in. in a 10x16-in. Hercules Blake jaw crusher and then raised in a bucket elevator to a ½-in vibrating screen. Material passing through the screen falls directly into a 76-ton cone-bottom steel ore bin; the oversize is lifted in a short bucket elevator to a 60-ton steel bin.

Oversize material is fed directly from the bin into a 4x60-ft. Gould rotary calcining furnace by means of a bumper type feeder. The resulting calcine is discharged from the furnace into a 5-ton reinforced-concrete and firebrick sinter bin and allowed to remain there about two hours before settling on to a continuously moving apron conveyor and taken to the rear of the furnace building, where it is removed by a 20-hp. drag-line scraper.

The fine material is carried from the 76-ton bin on a 16-in. x 40-ft. belt conveyor to an eight-hearth, 16-ft. diameter Nichols Herreshoff roasting furnace and elevated to the top hearth of the furnace in a belt-bucket elevator. Discharge from the Herreshoff furnace is by gravity through a chute on to the same apron conveyor which handles the coarse calcine from the tube. The Herreshoff furnace is of the standard type manufactured by the Pacific Foundry Company, of San Francisco, the principal modification being made where the roast gases escape from the furnace.

The two furnaces are equipped with separate condensing systems up to the last stage, in which operation low-temperature gases from both furnaces enter the same wooden settling tanks.

Exhaust gases from the rotary furnace are first pulled through two 48-in. Rees cyclones by a small high-speed fan, and about 96 per cent of the contained dust is eliminated. The dust settles into hoppers at the bottoms of the cyclones and is blown out on to the dump by means of compressed air. The gases are forced from the cyclones into a battery of 48 8-in. x 8-ft. especially made ¼-in. cast-iron pipes arranged in six rows of eight each. Over 80 per cent of the quicksilver condensation takes place in these pipes, the aim being to discharge the gases into vitrified tile pipes at a temperature a little above the condensing point of water.

From the cast-iron condensers the gases are pulled through a 22-in. vitrified tile pipe into a battery of 112 8-in. x 10-ft. pipes of the same material arranged in fourteen rows of eight each. A fan placed between the tile condensers and the wooden tanks pulls the gases from the first row of iron pipes through the pipe system and forces them into the settling tanks, which arrangement produces an inward draft at all points and a resulting lessened chance for salivation and sublimated mercury loss.

Herreshoff furnace and lower part of rotary furnace

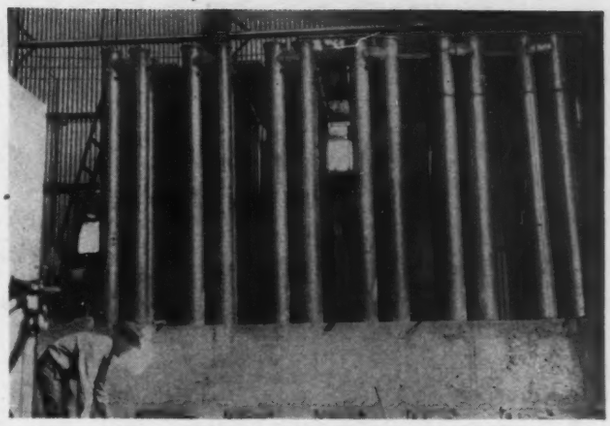
The gases from the Herreshoff furnace are first pulled through a 67-in. cyclone, which exhausts about 72 per cent of the total dust, and then through a 58-in. cyclone, which exhausts about 20 per cent of the total dust, the much finer dust being advanced accounting for the lower cyclone efficiency compared with the cyclones on the rotary furnace. The cleaned gases are then pulled through 64 8-in. x 8-ft. black iron pipes and 32 monel-metal pipes of the same size arranged in twelve rows of eight each in the same battery. Monel pipes were substituted for the tile pipes in the other unit. A fan driven by a variable-speed motor pulls the gases from the metal cyclones through the condensing pipes and forces them into two small redwood tanks fashioned on the cyclone principle, which are 5 ft. in diameter and 10 and 12 ft. high, respectively. From these the gases pass into the four 12x16-ft. high redwood settling tanks, a 40-ft. wood-stave stack on the last tank drawing away the residual gases. No water sprays or water-jacketed cooling devices of any description are employed.

Under ordinary conditions the ore passes through the rotary furnace running at a speed of 72 revolutions an hour, in about 55 min. It is dropped into the calcine bin at a cherry heat, the object of the bin being to allow

The cyclones connected to the Herreshoff furnace

any remaining mercury in the ore to sublimate and to effect a saving in fuel by pre-heating the combustion air drawn into the furnace. The ore remains in the Herreshoff furnace on the average of one hour and 45 minutes. The rotary furnace has a capacity of about 50 tons of the coarser material a day, and the Herreshoff a capacity of about 85 tons of the fine material. Before installation of the Herreshoff, about 35 tons a day was calcined by the rotary furnace. No appreciable difference has been noted in the mercury content per ton of ore treated in each furnace, which result is probably because the mineralization is not confined to cleavage faces and by reason of the variation in the hardness and fracture of the ore from the different stopes. The quantity of sized ore for each furnace is regulated by slight changes in the jaw crusher adjustment and the occasional use of a $\frac{1}{4}$-in. screen.

In practice, the method of handling the dust made by the two furnaces has proved extremely satisfactory. The rotary furnace has shown itself to be inherently more of



Condensing pipes for the Herreshoff furnace

an offender than the rabble stirred unit from a dust standpoint, but with the former treating coarse ore, the only dust resulting is that made by the calcining operation and the abrasive action of the revolving tube. The cyclones on the Herreshoff furnace collect an average of 135 cu.ft. of extremely fine dust every 24 hours, 80 per cent of this being arrested in the first cyclone. Carefully metered oil flow into both furnaces indicates a consumption of 7.2 gal. a ton for the rotary furnace and 5.4 gal. for the Herreshoff. A 27 deg. Baumé oil is used for both furnaces and the Diesel engines, and is placed in a 40,000-gal. storage tank at the mine for 8c. a gallon.

The rotary furnace is equipped with a No. 9 Witt high-pressure burner, which injects the oil and air together at 50 lb. pressure. Two No. 90 Mahr triple atomizing burners are kept fired regularly on hearth No. 4 of the Herreshoff furnace (the hearths are numbered from the top down, exclusive of the top or drying hearth), and a smaller burner is kept fired as a "booster" on hearth No. 2. Two burners are installed on hearth No. 6, but are used only in heating up the furnace. The Herreshoff furnace is equipped with a recording pyrometer, which indicates the temperatures on hearths No. 4 and 6 and of the gases entering and escaping from the cyclones. Average temperature on hearth No. 4 is 1,300 deg. F., and on hearth No. 6 is 1,000. deg. F. Gases entering the cyclones have a temperature of 470 deg. F. and on leaving them a temperature of 450 deg. F. A recording pyrometer on the rotary furnace indicates the temperature of the gases entering the condensing pipes, which is about 470 deg. F.

The iron condensing units of each furnace are cleaned every other day, and the tile condensers of the rotary furnace once a week. When cleaning the condensers, the speed of the fan between the pipes and the redwood tanks is increased and the iron doors on the cement receiving chambers are opened. The free mercury runs into a concrete launder, which has an outlet into one of two submerged cast-iron pots having a capacity of 100 flasks each. The "soot" is removed by a scraper, and hoed in a metal-lined box, no lime being added to assist in the extraction. The residue, which amounts to a quantity sufficient to fill two wheelbarrows daily, is dumped at intervals onto the conveyor belt leading to the Herreshoff furnace.

Increased efficiency of the dust arresters in the plant has minimized the effectiveness of the large settling tanks, and their rôle in the saving of the "quick" is a

(Continued on Page 508)

FLOATING OF CARBONATE AND

By

F. D. DEVANEY *and* J. B. CLEMMER

U. S. Bureau of Mines

THE steel industry is the largest single consumer of manganese. Appreciable tonnages are also used by the battery and ceramic industries each year. In our own industries consumption is far in excess of our domestic production. This can be attributed in part to the fact that although large tonnages of manganese oxide ores are known to exist in the United States, a relatively small part of these ores is of a grade sufficient to meet the requirements of the industry without preliminary concentration. An economical and efficient means of concentrating the low-grade oxide ores would greatly augment our domestic production and reserves.

During the last fourteen months the U. S. Bureau of Mines, in co-operation with the Missouri School of Mines and Metallurgy, has carried on at its Mississippi Valley Experiment Station at Rolla, Mo., an extensive investigation of the manganese ores of the country. Over a hundred ores from all parts of the United States have been examined and studied to determine their amenability to concentration by gravity processes such as jigging, tabling, and magnetic methods.[1] In addition to determining the results which could be obtained on these ores by the older well-known methods of gravity and magnetic concentration, an endeavor has been made to improve these old methods and to devise new means of treating ores efficiently which cannot be milled economically by the methods now in use. One of the outstanding developments of this study has been the application of the flotation process to both the carbonate[2] and oxide ores.

In the last five years research work conducted by the Bureau of Mines and its co-operating agencies at Salt Lake City, Utah; Tuscaloosa, Ala.; Rolla, Mo., and by commercial firms has shown that many of the nonmetallic minerals such as phosphate rock,[3] fluorspar,[4] and bauxite[5], and limestone can be successfully separated from their gangue minerals by flotation. To this list we now wish to add the manganese carbonate, rhodochrosite, and the manganese oxides, pyrolusite, psilomelane, and manganite . . . Ores containing soft manganese minerals, such as pyrolusite, slime badly when treated on jigs and tables, and much of the mineral is lost in the slime. This slime forms an ideal flotation feed and lends itself well to the process.

The authors wish to acknowledge the assistance of Will H. Coghill, supervising engineer of the station, under whose direction the work was done, and the co-operation of the American Manganese Producers' Association, the officials of which have kindly furnished us with samples of their ores.

FLOTATION OF RHODOCHROSITE

In the Butte area of Montana occur large quantities of manganese ore in the form of the carbonate, rhodochrosite, which is associated with rhodonite quartz and small quantities of lead and zinc in the form of sulphides. The Domestic Manganese & Development Company, is at present treating ore from the Emma mine, calcining it to produce a very high-grade concentrate. In addition to the ore that is susceptible to this treatment, are found large tonnages of lower-grade ore which, because of its complexity, must be concentrated before calcination if a high-grade product is to be produced. According to estimate, the Butte district contains at least 2,000,000 tons of carbonate ore. Large quantities of this ore are also expected to be found at depth in the Phillipsburg district of Montana. Smaller bodies are known to occur near Sevierville, Tenn., and near West Cummington, Mass.

Owing to the size of the Emma mine orebody at Butte, most of the research work done at Rolla on carbonate ore has been on ore from this property. A representative sample requiring concentration obtained at this mine was found to be about one-half quartz; some lead, zinc and iron sulphides were also present. The rhodochrosite amounted to nearly 40 per cent of the sample, so that the sample ran about 20 per cent in manganese. The sample was taken across a 45-ft. vein, no part of which could be mined to produce a high-grade ore—that is, one containing 36 per cent or more manganese.

After a number of experiments, a satisfactory method of concentrating this ore by flotation was worked out. Briefly, the precedure consists of grinding the ore to approximately 100 mesh and then treating it in a mechanical type of flotation machine. Most of the sulphides are readily removed by the use of a small amount of xanthate, copper sulphate, and pine oil. The rhodochrosite is then floated by adding sodium oleate and pine oil. Quartz in the ore is little effected by the reagents added, and most of it passes into the tailing. The rougher concentrate, consisting of rhodochrosite and

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[1]DeVaney, F. D., and Coghill, W. H.: "Beneficiation of Oxidized Manganese Ores by Magnetic Separation of Roasted Jig Concentrates." Reports of Investigations 2936, U. S. Bureau of Mines, 1929, 4 pp.

[2]DeVaney, F D., and Coghill, W. H.: "Preliminary Ore-Dressing Tests to Recover Manganese in Rhodochrosite Ores." Reports of Investigations 2902, U. S. Bureau of Mines, 1928, 4 pp.

[3]Lawrence, H. M., and DeVaney, F. D.: "Flotation of Low-Grade Phosphate Ores." Reports of Investigations 2860, U. S. Bureau of Mines, 1928, 4 pp.

[4]Coghill, W H., and Greeman, O. W.: "Flotation of Fluorspar Ores for Acid Spar." Reports of Investigations 2877, U. S. Bureau of Mines, 1928, 3 pp.

[5]Gandrud, B. W., and DeVaney, F. D.: "Preliminary Examination of Low-Grade Bauxite with Particular Reference to Flotation." Reports of Investigations 2906, U. S. Bureau of Mines, 1928, 8 pp. Also, Gandrud, B. W. and DeVaney, F. D.: "Bauxite; Float-and-Sink Fractionations and Flotation Experiments" Bull. 312, U. S. Bureau of Mines, in press.

E AND OXIDE MANGANESE ORES

some entrained quartz, is cleaned by being refloated in a flotation cell.

Sulphide concentrate made on a typical run had a tenor of 8.1 per cent lead, 18.4 per cent zinc, 21.3 per cent iron, and 3 per cent manganese. In it was entrained less than 1 per cent of all the manganese. No investigation was made of the byproduct value of this concentrate, but because of its lead and zinc content it should be salable enough to yield a revenue of some importance.

The cleaner concentrate made by flotation contained 67.7 per cent of all the manganese and assayed 41.55 per cent manganese; and the rougher tailing ran less than 5 per cent in manganese and contained 10.8 per cent of the total manganese in the sample. The cleaner tailing or middling had a tenor of 27.35 per cent manganese and represented 31.7 per cent of the total manganese in the feed. In plant operation the amount of manganese recovered in the concentrate is increased by part of the manganese in the cleaner tailing or middling; individual tests have shown this product is amenable to further cleaning. The finished concentrate contained 6.9 per cent insoluble matter, and the rougher tailing 89.8 per cent. The result shows a decided selectivity.

Reagents used in the above tests and their cost per ton of feed are as follows:

Copper sulphate	— 0.5 lb. at 18c. per pound =	$0.10
Sodium ethyl xanthate	— 0.2 lb. at 17c. per pound =	0.04
Pine oil	— 0.4 lb. at 10c. per pound =	.04
Crude sodium oleate	— 1.0 lb. at 7c. per pound =	.07
Total		$0.25

As has been said, the sample is about one-half quartz, and quartz is very hard to grind. If a part of it could be removed by gravity concentration before grinding to flotation size, the cost of grinding would be reduced and the enriched flotation feed thus obtained would be more amenable to cleaning.

Accordingly, a sample was ground to 10 mesh and classified into ten spigot products and an overflow product. One of the intermediate spigot products was tabled. The specific gravity of rhodochrosite is 3.6; that of quartz about 2.65. The relative densities indicate that a separation should be obtained. Two obstacles to gravity concentration are the fine dissemination of the quartz in the rhodochrosite, and the interlocking of the sulphides and quartz. This interlocking is troublesome because some of the composite grains have the same density as rhodochrosite. Crushing to 10 mesh is too coarse to liberate the minerals, though it might be economically feasible.

On this ore a merchantable concentrate could not be made by tabling, but approximately 55.3 per cent of the quartz may be rejected with a loss of 12.4 per cent of the manganese. In good commercial operation the same amount of rejection would be expected with a loss of from 5 to 10 per cent manganese. Tabling would also make an appreciable recovery of sulphides. Apparently, the most efficient and economical way to concentrate this ore would be to crush to 10 mesh, classify, table and reject the clean quartz; the ore would then be crushed to flotation size and floated.

A Further Step in the Utilization of Low-grade Reserves

Flotation is sometimes erroneously regarded as the process that will do all things; it should be regarded as "a" process rather than "the" process. Good milling consists in the intelligent linking together of the economic combination of processes. Of course simplicity is desirable, and a single process gives the most simple flow sheet, but combinations must be given consideration. The goal is conservation at a profit.

In concentrating rhodochrosite ores which contain the manganese silicate, rhodonite, the flotation process has decided advantages over straight gravity and high-intensity magnetic processes. Rhodonite, being a silicate, must be largely eliminated from the manganese concentrate, since its presence tends to make the silica content too high to permit the product to be used for making ferromanganese. The specific gravities of rhodochrosite and rhodonite are so nearly the same as to make it impossible to make a good separation between them by tabling. An interesting result of research work on manganese ores has been the discovery that all the manganese minerals studied, whether oxides, carbonates, or silicates, are attracted by a high-intensity magnetic current. In rhodonite and rhodochrosite the magnetic permeabilities are so nearly alike that to differentiate between them is impossible. Experiments with flotation on ores containing these two minerals, however, have proved definitely that a good separation can be made by this process. Rhodochrosite floats, and the silicate, rhodonite, goes into the tailing.

Floating Manganese Oxides

Oxide manganese ores of this country and of the world supply industry with the major part of its manganese requirements. But only a few of these ores can be used without concentration. The low-grade oxide ores are in general amenable to gravity-concentration methods. Little difficulty is encountered in concentrating clean ores; on the other hand, many ores, because of their physical composition, yield low-grade concentrates with a low or only medium-high recovery. Particular attention has therefore been given these difficult ores in the Bureau's investigation, inasmuch as they are of the type which can best be treated by flotation.

In attempting to float the oxide manganese ores, much work has been done on a large variety of so-called difficult ores from various localities. In this class are included those ores in which the manganese present is in a soft condition and which would be lost in the slime should jigging and tabling be employed for their concentration. Log washer overflows, which now go to

waste, often contain an appreciable amount of manganese recoverable by flotation.

Preliminary tests on the oxide ores gave definite indications that the oxide minerals are floatable. A series of tests was carried on in which a satisfactory method of concentrating the ore was worked out. Briefly, the procedure is as follows:

As a preliminary treatment, the ore is given a reduction by being passed through a jaw crusher and rolls; the crushed product is then ground in an Abbé mill through 100 to 150 mesh. The ground ore is treated in a mechanical type flotation machine. The rougher concentrate, consisting principally of the mineral and some free gangue is cleaned by refloating in the flotation cell.

Results of a typical test on a soft ore in which the manganese mineral is primarily pyrolusite are as follows:

From the ore which contained 25.3 per cent manganese and 54 per cent insoluble material, a finished concentrate was produced which contained 56 per cent manganese and accounted for over 91 per cent of the total manganese in the sample. The rougher tailing, which is discarded, had a tenor of less than 2 per cent manganese —less than 4 per cent of the total manganese. The cleaner tailing, or middling, ran 16.7 per cent manganese and accounted for approximately 5 per cent of the total manganese. In the plant the cleaner tailing, or middling, would be returned to the flotation machine, with the result that the manganese which it contains would eventually be recovered. By following this method, over 96 per cent of the total manganese in the sample is recoverable by flotation. The finished concentrate contained 4 per cent of insoluble material and accounted for only 3 per cent of the total insoluble material in the sample. This shows that, by flotation, over 96 per cent of the manganese in the sample is recoverable in a concentrate and 97 per cent of the insoluble or gangue material is rejected. The iron content of this sample was low and was not considered.

The reagent charge figured on the basis of cost per ton of ore is as follows:

Pine oil	— 0.12 lb. at 10c. per pound =	$0.012
Oleic acid	— .21 lb. at 10c. per pound =	.021
Sodium silicate	— 2.50 lb. at 1.5c. per pound =	.040
Sodium carbonate	— 2.50 lb. at 2.0c. per pound =	.050
Total		$0.123

The foregoing combination of reagents was satisfactory on all ores tested. As to the individual reagent, the quantity required varies somewhat with the ore treated, but is not far from the figures given in the foregoing charge. Other reagents of characteristics similar to those given have been investigated. With certain ores palmitic acid gives slightly better results than oleic acid. For best results the reagent charge must be adapted to each ore treated.

A point which may be well brought out at this time is the effect of temperature upon the flotation of manganese oxides. When the fatty acids, such as oleic, stearic, or palmitic, are used as collectors, heating the pulp to a temperature exceeding the melting point of the acid decreases the amount of reagent required and materially speeds up the flotation process. The grade of the concentrates and the recovery is improved by floating in a hot pulp. A high pulp density is also beneficial in improving the results.

Difficulty has been experienced in applying flotation to ores containing large amounts of iron as limonite. Limonite slimes badly on grinding and can be only partly eliminated in the process. Clay slime, such as that found in log-washer overflows, presents a similar problem. In the presence of large amounts of slime, either iron or clay, only fair-grade concentrate can be produced. This phase of the problem is receiving much attention at present.

Those well versed in flotation know that many pitfalls exist between laboratory results and commercial performance. The hazard may be reduced by making miniature mill runs subsequent to the laboratory work. Laboratory work has an important place; if selectivity is not manifested in the laboratory, further work on a large scale is useless, but satisfactory laboratory results do not assure the subsequent steps. Laboratory flotation is only one step in the development of the process. Mill runs may be made in commercial laboratories; they constitute the second step. Reducing the hazard by proceeding with caution is urged.

We feel that the use of flotation in concentrating manganese ores offers great possibilities. The process is especially applicable to the concentration of carbonate ores. With oxide ores its application should be especially valuable in concentrating those ores requiring fine grinding, if a high-grade product is to be made, and in handling ores containing soft manganese minerals which slime badly, causing excessive losses if an attempt is made to jig or table them.

Within the last two years successful commercial plants have been erected for floating non-metallics; one of these plants is concentrating phosphate ores and the other is making a very high-grade concentrate from fluorspar ores. We are confident that at no far distant date flotation plants working on manganese ores will be in operation in this country, and that the adoption of this process will result in increasing the manganese reserves of the country and in more efficient plant operation. Low-grade and complex ores can be treated by this process; higher recoveries will be made in the mills because of the recovery of the soft manganese minerals which under present methods are largely lost in the slimes.

Recent Progress in the Metallurgy of Quicksilver

(Continued from Page 505)

doubtful one, 60 days' operation resulting in the saving of less than 200 lb. of a low grade "soot." Assays on the regularly burned calcine from both furnaces show a trace of mercury, and the stack loss is practically nil.

The mill crew consists of a furnace man and a man to operate the crusher and drag line on each shift. In addition, on the day shift, a "soot" man, a repair man, and a furnace foreman are employed. In the average mine operations two machines are employed on mining and three on development work. A crew of three men tram the ore in one-ton cars to the mill.

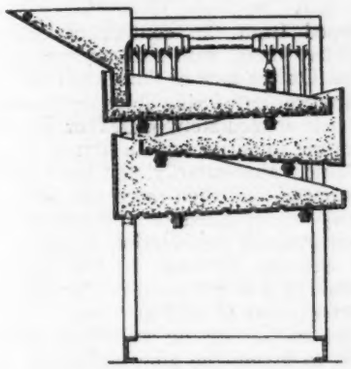
The camp consists of two bunk houses and other structures capable of housing more than 40 men, office and superintendent's quarters, and a cook house with refrigeration chamber and an eating room. Water is scarce in the region, and a serious shortage is threatening, but sufficient for ordinary needs has been piped in a 1¼-in. line from Antelope Springs, nearly two miles away.

G. H. Jones, of Chicago, is president of the company; W. G. Adamson, is vice-president and general manager; J. H. Hartley, superintendent; and A. Livingstone, secretary-treasurer.

PATENTS

CONCENTRATOR. No. 1,719,958. July 9, 1929. L. W. Beney and E. G. Messer, Elma, Wash.

A concentrating and separating mechanism consisting of a series of pans, the



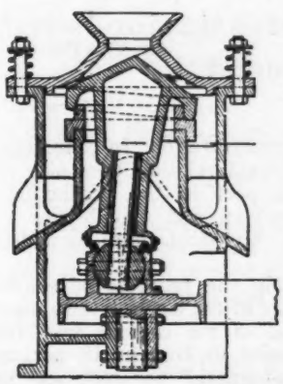
bottoms of which are equipped with riffles. Means for supporting the pans and giving them a reciprocating motion parallel to the direction of the riffles are provided.

METALLIC SULPHATES. No. 1,719,534. July 2, 1929. M. F. Coolbaugh and J. B. Read, Denver, Colo.

A method of treating sulphur containing minerals to form metallic sulphates.

CRUSHER. No. 1,721,246. July 16, 1929. J. Bossart, Los Angeles, Calif.

Design for a gyratory crusher.



MINER'S CAP. No. 1,722,869. July 30, 1929. J. Vanusek, Republic, Pa.

Design for a miner's safety helmet cap.

CONCENTRATOR. No. 710,862. July 16, 1929. A. H. Stebbins, Los Angeles, Calif.

Design for a table concentrator.

FLOTATION MACHINE. No. 1,722,705. July 30, 1929. S. E. Meyer, Hayden, Ariz.

Design for flotation machine of the pneumatic type.

VIBRATORY SCREEN. No. 1,721,802. July 23, 1929. C. K. Baldwin and S. D. Robins, assignors to Robins Conveying Belt Company, New York, N. Y.

A design for a vibrating screen.

CRUSHING MACHINE. No. 1,719,549. July 2, 1929. W. R. Hume, Melbourne, Australia.

A crushing machine of the roll type which reduces the material treated by a combined rolling and percussive action.

SEPARATING MINERALS. No. 1,719,171. July 2, 1929. T. M. Davidson, Hatch End, England.

An apparatus of the general classifier type for the washing and separating of minerals.

JAW CRUSHER. No. 1,719,333. July 2, 1929. J. E. Kennedy, New York, N. Y.

A jaw for crushers, having a rectangular member with an integral tubular portion which supports the jaw in the crusher frame.

BALL MILL. No. 1,719,164. July 2, 1929. R. Bernhard, assignor to Traylor Engineering Company, Allentown, Pa.

A multiple compartment ball mill, including a pair of adjacent grinding compartments.

MINING SULPHUR. No. 1,719,981. July 9, 1929. W. Judson, assignor to Texas Gulf Sulphur Company, New York, N. Y.

An improvement in the mining of sulphur by underground fusion from partly exhausted sulphur deposits.

MICA-SORTING MACHINE. No. 1,720,666. July 16, 1929. J. M. Coffey, assignor to Mica Insulator Company, New York, N. Y.

A pneumatic machine for grading mica flakes.

ORE-ROASTING FURNACE. No. 1,723,006. Aug. 6, 1929. R. A. Bennett, Denver, Colo.

An ore-roasting retort furnace consisting of a series of horizontal retorts arranged one above the other.

TREATMENT OF SULPHUR. No. 1,723,815. Aug. 6, 1929. J. W. Schwab, assignor to Texas Gulf Sulphur Company, Bay City, Tex.

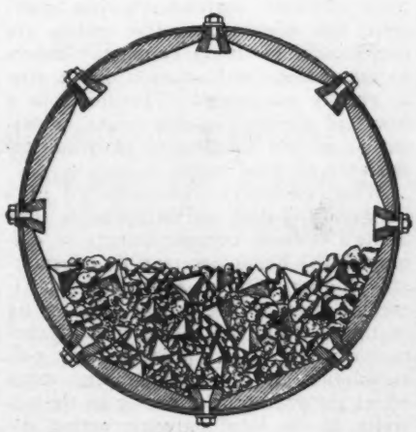
A method for improving the color of sulphur by treating it in a molten condition with finely divided zeolites.

DESLIMER AND CLASSIFIER. No. 1,729,810. July 16, 1929. J. R. Wright, Denver, Colo.

A hydraulinc classifier of the tank type. An auxiliary belt contacting with the discharge belt prevents material being drawn by surface tension from the discharge belt.

GRINDING MILL AND MEDIA. No. 1,720,024. July 9, 1929. D. H. Young, assignor to American Manganese Steel Company, Chicago, Ill.

An ore grinding mill, the grinding elements of which are constructed in the form of a polyhedron.



CONCENTRATING TABLE. No. 1,723,795. Aug. 6, 1929. M. J. Lide, Birmingham, Ala.

Design for a concentrating table of the mechanical type.

IGNITER. No. 1,719,114. July 2, 1929. R. W. Hyde, assignor to Dwight & Lloyd Sintering Company, New York, N. Y.

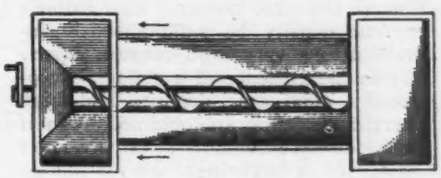
An igniter for sintering machines. Electrically developed heat is used to bring the surface of material in the pallets to ignition temperature; completion of combustion after ignition is effected with gas.

LEACHING. No. 1,720,138. July 9, 1929. H. Neumark, Frankfort-on-the-Main, Germany.

A process for working up solutions obtained by leaching ores which have been subjected to a chloridizing roast. Copper is precipitated with iron, sulphates are then removed, and zinc is next precipitated by treating the solution with gases containing hydrogen sulphide.

FLOTATION MACHINE. No. 1,720,264. July 9, 1929. R. R. Tananarive, Madagascar.

A flotation machine for treating graphite and other minerals. Agitation and aëra-



tion are provided by injecting water through a series of holes placed in the bottom of a central gutter, in which a screw conveyor operates. The conveyor moves the ore along the gutter and mixes it with the air-laden water injected into the gutter.

CONCENTRATOR. No. 1,723,711. Aug. 6, 1929. V. P. Roe, Clarkston, Wash.

Design for a concentrator consisting essentially of two mechanically oscillated pans.

ROASTING FURNACE. No. 1,721,265. July 16, 1929. N. T. Wellman, assignor to General Chemical Company, New York, N. Y.

A mechanical multiple-hearth roasting furnace equipped with a device for supplying sulphur to one of the lower hearths.

ZINC PROCESS. No. 1,721,373. July 16, 1929. H. E. Coley, London, England.

A method of reducing zinc-bearing material. The material is agitated in an air-excluding tube and heated to its reduction temperature. A hydro-carbon cooled below its decomposition temperature is then introduced into the tube at a point below the surface of the mass of material.

Rock Drills

No. 1,721,674. July 23, 1929. W. A. Smith, assignor to Ingersoll-Rand Company, Jersey City, N. J.

A blowing device for a rock drill.

No. 1,722,090. July 23, 1929. A. T. Holman and P. M. Holman, assignors to Holman Brothers, Ltd., Camborne, England.

Design for a rock drill and rock drill mechanism.

COMMENT AND CRITICISM

Zinc Cathode Corrosion Apparently Is Beneficial

Preliminary research has unearthed some seemingly paradoxical facts about electrolytic zinc recovery . . . Benefits of high-acid method may also be obtained in a low-acid circuit . . . Exceptional results were obtained in a laboratory trial run, but continued experimentation is necessary for complete substantiation, says a California metallurgist

To the Editor of "E.&M.J.":

Though the assertion that zinc cathode corrosion is apparently beneficial may at first sight appear preposterous, yet it helps to explain the cathodic reaction in a zinc sulphate electrolyte employing high-acid solutions and high current density. Some years ago Pring and Tainton *(Journal of the Chemical Society, 1914)* showed that, with high current density and very strong acid, some anomalous results had been attained. They stated that if free-acid strength and cathode current density be simultaneously increased to a very high volume, especially in the presence of a colloid, exceptionally good zinc deposits and high current efficiency are obtained, even if the electrolyte contains relatively large quantities of impurities. To me the essential causes of the extraordinary good results obtained in the high-acid method are primarily the corrosion of the cathode and the simultaneous redeposition of zinc, producing at the cathode a high concentration of zinc sulphate. Chemical corrosion of the zinc cathode, detrimental as it is in low-acid electrolysis, is apparently advantageous in its effect in the case of high-acid solution in conjunction with high current density.

C. A. Hansen (*Transactions* A. I. M. E., 1919) suggests that two major reactions take place in the zinc sulphate cell using peroxidized lead anodes. Deposition of zinc at the cathode is at a rate which entirely depends upon the current density and varies according to Faraday's constant. Corrosion of the deposited zinc by the cell solution is at a rate which is independent of the deposition rate but which does not depend entirely upon the chemical activity of the solution and upon the zinc sulphate surface exposed. Corrosion rate, he maintains, is mainly determined by the acid concentration of the electrolyte. With a given acid concentration, the corrosion rate can be expected to increase with increased temperature.

G. Gore ("Electroseparation of Metals") states that, in an electrolytic vessel, ordinary chemical action proceeds simultaneously and side by side with the electrolytic ones. The two kinds of action frequently have opposite effects, he declares.

When two different metals are connected and placed in a fluid that acts on one more energetically than on the other, a current of electricity is generated. If the current is powerful enough, under favorable conditions, the dissolved metal will be redeposited upon the one less attacked. In this case, the strong sulphuric acid is the fluid, zinc the attacked metal, and the impurity (electronegative metal) in the solution the other metal. I have demonstrated *(Engineering and Mining Journal,* July 27, 1929) this phenomenon in the case of platinum and zinc in a process I have evolved for recovering platinum by amalgamation. The property of deposition by contact and local current has been used for plating articles with zinc. The articles are placed in a hot solution of zinc in contact with a large zinc surface.

On electrolyzing a solution of zinc sulphate, the resulting products are sulphuric acid and metallic zinc. Free sulphuric acid immediately reacts with the zinc to re-form zinc sulphate. In pure solutions, corrosion is less energetic, but if electronegative metals are present in the solution, commonly known as impurities, the resolution of the zinc is greatly augmented. Therefore, in a low-acid electrolytic zinc plant, purification of the solution is of vital importance to good work.

When electrolysis is conducted in a high-acid solution and at the same time a high cathode current density is employed, the impurities may be considerably higher without appreciable detrimental effect to the proper functioning of the cell and the influencing of current efficiency. In the electrolytic cell, re-solution of the cathode zinc takes effect instantaneously, owing to the activity of the local galvanic action developed from the contact of electronegative metal with zinc and sulphuric acid. On the face of the cathode a high concentration of zinc sulphate from the current immediately plates or plasters over the impurity with a film of metallic zinc. Momentarily, the local action is stopped, and then more zinc and impurity is deposited on the cathode by electrolysis of the solution produced by the external current. In the low-acid method this is not possible, because the concentration of acid and zinc sulphate at the surface of the cathode is insufficient to attack the zinc vigorously and create a violent local action. Electrolytic reactions function much more efficiently in solutions having a high metal concentration. In connection with a high-acid solution they play an important part in the production of a homogeneous and smooth zinc cathode in the high-acid, high-current-density method.

During the progress of electrolysis, a sample of the electrolyte in the neighborhood of the cathode was analyzed and found to contain 18 per cent of zinc, whereas 7 per cent was present in the main body of the solution. This is sufficient proof that an extremely active reaction takes place between solution and zinc.

Of the movement of the electrolyte, Tainton (*Transactions* of the American Electrochemical Society, 1922) says that, with reference to the circulation, the beneficial effect on the deposit of a rapid movement of the electrolyte past the cathode is a general rule of electrochemistry. How the movement of the electrolyte past the cathode operates to prevent tree formation is not quite clear, but he considers that it may perhaps be regarded as a mechanical action due to the friction of the solution.

Some mixing of the electrolyte occurs because of high current density, which produces a rapid upward movement past the cathode. But the liquid, being confined to an extremely narrow chan-

nel next to the cathode, has little opportunity to diffuse throughout the body of the electrolyte. The cathode is surrounded by a solution differing in density from the rest of the electrolyte. In other words, we have, in this case, a liquid diaphragm cell. The junction of the two dissimilar liquids forms the diaphragm.

An experiment showed that the beneficial effect of the high-acid method may also be obtained in a low-acid circuit by the employment of an electrolytic cell provided with two solutions differing in specific gravity. The cell consists of a tall narrow tank. Through the center is a shaft on which is mounted a disk of aluminum to serve as the cathode. In the upper half of the cell above the shaft two lead anodes are suspended. In the side of the tank stuffing boxes are affixed in which the shaft rests. Electrical connection is made to the source of current by means of a spring contact brush, bearing on the shaft on the exterior of the cell. On the opposite end of the shaft a crank is attached to impart a rotary motion to the cathode. The lead anodes suspended in the upper part of the cell on each side of the cathode are connected on top to a wire leading to the source of electric current.

In the lower half of the cell a 50 per cent sulphuric acid solution is placed. Above this is a nearly neutral zinc sulphate solution, carrying 10 per cent zinc and 20 mg. per liter of cobalt. The current density averages about 30 amp. per square foot.

Fresh electrolyte is introduced into the upper zone in the cell by means of a rubber tube, and slowly circulated through the cell during electrolysis. When the cathode is rotated slowly, the solutions keep well stratified, and little mixing occurs.

The current density averaged about 30 amp. per square foot of cathode surface. As means were not available to make accurate measurements, no calculation of current efficiency was attempted, and all results were determined empirically. However, the zinc cathode was exceptionally dense and smooth, and showed slight indications of dissolution when placed in a warm dilute sulphuric acid solution. The results were so encouraging that I intend to repeat the experiment with a much larger cell, using several cathodes on the shaft.

In conclusion I wish to state that the facts I have disclosed are products of cogitation and meager laboratory experiments. To substantiate them, exhaustive experiments would have to be made on a larger scale.

VICTOR I. ZACHERT.

San Francisco

Mexico—A Land Flowing With Mercury

To the Editor of "E.&M.J.":

The attached letter may be of some interest to you and to your readers. I particularly call your attention to the local color supplied by the coconut shells. This would seem to be a patentable invention as compared with the cumbersome flasks at present in use.

G. H. BUCHANAN.

New York.

1,700 E. 20th Street, Oakland, Calif.
August 16, 1929.

American Cyanamid Company,
535 Fifth Avenue,
New York.

Gentlemen:

Your address was given us by the State Mineralogist, of San Francisco, Walter W. Bradley, as a firm that wants to buy quicksilver.

We have a large deposit of quicksilver in Mexico from which we can supply you all the quicksilver you wish to buy. This quicksilver is on lands occupied by an Indian tribe. There are many thousands of acres. There are hundred and hundreds of ledges saturated with quicksilver. There seems to be an unlimited supply. It filters out of the rock, and the Indians gather it up in coconut shells, and deliver it to the R.R. depot to us for 25c. a pound. They will deliver all we order them to bring, and as fast as we order it. There are thousands of these Indians, and they are peaceable, honest and good workers. We have had them work for us many years ago. They do not allow any lawlessness on their home lands. We are better protected than we would be in any part of the United States. These are the terms on which we can supply you with all the quicksilver you want: Send us $5,000 or any sum less or more as you wish, but not less than $1,000 to buy the quicksilver as we order it brought to us to the depot, by the Indians, who bring it to us and sell it to us for 25c. a pound.

Send the money to Leslie and Landes to be drawn by George H. Leslie. Deposit the money in the Canadian Bank of Commerce in Vera Cruz, and we will buy all your money will pay for at 25c. a pound and ship it to you and give you one-third of the values, you to collect and deliver to us our part in the bank, the Canadian Bank of Commerce of Vera Cruz.

We have just received from two firms $5,000 and $2,000 to buy for them on these terms, and we can quickly fill your order for the metal to whatever amount you wish us to buy for you.

Yours very truly,
LESLIE, LANDES & COMPANY,
(Signed) Z. T. LANDES, Sec'y.

A Reader for 53 Years and a Subscriber Since 1889

To the Editor of "E.&M.J.":

I note the letter of the old-time reader in your issue of Sept. 7, and your invitation for other old-timers to communicate their experiences. I have been a reader since 1876 and a subscriber since 1889. WILLIAM H. HAMPTON.

Portland, Ore.

A Correction and a Greeting From Germany

To the Editor of "E.&M.J.":

In *Engineering and Mining Journal* of Aug. 10, 1929, on p. 217, you quote Dr. P. Martell under the heading, "Miners in Germany Showed Meticulous Care in Diction." He was referring to the old German miner's greetings, "glückauf," and continues to say: "They would take it badly if greeted by 'glückzu,' because the underground passages and openings must remain open and not close up. It would appear, then, that 'glückauf' is really a contraction of 'May good luck open for you,' in contrast to 'May good luck shut you in (the mine).'"

This is not in accordance with the real meaning. When the German miner says "glückauf," he means that the veins and galleries may open and extend. Dr. Martell confused veins and galleries with underground passages and openings. The question here is not that the underground passages should remain open, nor the danger that they might crumble, but rather that the thickness and the grade of the vein may improve with development.

Not the anxiety or care for life is the explanation for the miner's beautiful greeting "glückauf," but the wish that the mine may be abundantly productive. I shall be pleased if you will publish this little correction for your readers, so as to avoid that this wrong idea may take root with our mining colleagues in your country. I greet you with the old German greeting, "Glückauf." E. J. IVERS.

Dresden, Germany

Concentration of Chrome Ore

To the Editor of "E.&M.J.":

In your issue of Sept. 14 you have an editorial on the subject of the utilization of low-grade chrome ores. I would like to draw your attention to the fact that I successfully treated—during the war—low-grade chrome ore by electromagnetic separation, and not only obtained a concentrate showing between 55 and 60 per cent Cr_2O_3, but reduced the silica content below 2 per cent. The only objection to treatment by electrometallurgical methods was the cost involved. I believe, however, that if a sufficiently large amount of chrome ores is available to warrant the construction of special machinery, economical treatment of low-grade ore will become possible.

My operation during the war used an installation originally designed for the treatment of more valuable ores, where quality and not quantity was the main object. For an article which sells at around $20 to $25 a ton, low operating costs are essential. Such costs I believe can be achieved.

CHARLES HARDY.

New York

USEFUL OPERATING IDEAS

Controlled Preheating Necessary to Satisfactory Welding

Loose firebrick make efficient preheating furnace

PREHEATING facilities necessary in a welding shop or department depend upon the run of work handled. Cast-iron welding forms perhaps a major part of the average welding shop's daily work, and the shop manager should give close study to preheating problems with the various types of castings. Small pieces can be preheated by the oxy-acetylene blowpipe and welded without difficulty. This method, however, is not practicable for larger pieces. A blacksmith's forge is sometimes used, but with this there is the possibility of overheating or burning the metal on one side, if constant care is not exercised.

The most practicable and economical method of preheating large pieces, particularly where the entire casting is to be heated, is the use of the temporary firebrick furnace. This is built of loose firebrick laid without mortar, quickly constructed, and of any size desired. The accompanying illustration shows a large preheating furnace incasing a heavy iron casting. Asbestos paper, having holes for draft if necessary, forms the top of the furnace. The spacing of the bricks around the base of the furnace assures sufficient draft to raise the piece to the proper temperature.

To keep a desired temperature, the fire must be regulated occasionally while the welding progresses. This is done by opening or closing the draft holes, rearranging the asbestos paper covering, moving hot coals from one place to another, or replenishing the fire whenever necessary. This important detail is usually performed by a helper. When the casting has reached an even and dull-red heat, an opening is made in the asbestos paper cover just large enough to uncover the weld area, and welding is done through this hole.

After the weld is completed it is as important to secure proper cooling. The entire casting or piece should be covered with fresh charcoal and brought up to an even heat. With the asbestos covering intact, the finished work should be allowed to cool and contract evenly in the dying fire. It is important that one part does not cool quicker than any other. If this happens the piece may crack by reason of the development of an uneven "pull."

Preheating and annealing of cast iron is an essential part of welding technique. It is not a difficult feature. The methods of constructing the preheating furnace and governing the preheating temperature are simple.

Grinding Tungsten-Carbide Tools

IN THE old carbon-tool days a small oil stone was part of every lathe man's kit, to use in stoning the finishing tools to a smooth cutting edge, writes John R. Godfrey in *American Machinist*. As with almost everything else, some men overdid it, and "stoned the tools to death"—that is, they not only smoothed the edges but dulled them. With the introduction of high-speed steel tools and the grinding machine as a finishing operation, the oil stone disappeared except in the toolroom or for stoning reamers.

The new tungsten-carbide tools seem likely to bring back the oil stone or its equivalent—a lap charged with fine abrasives that is hard enough to cut the new alloys. And not so much for the purpose of securing a smooth surface on the material as to preserve the utility of the tool itself.

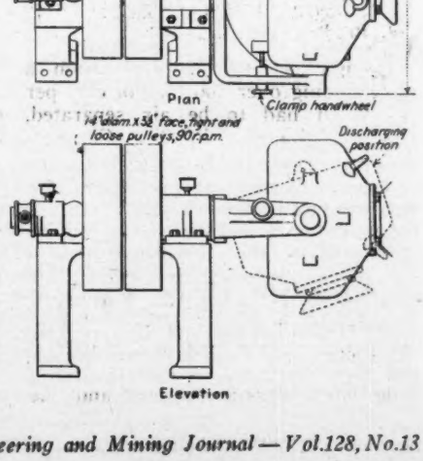
Under a microscope the edge left by the usual grinding wheel is a series of serrations, the size of the teeth depending on the grain of wheel used. These teeth, or minute projections, seem to give way under heavy cuts, or vibrations. By smoothing the edge and removing these "points," the tools stand better and may give better results in finishing. For those who have begun to use these new tools it is suggested that they be ground first with a 60 wheel, then with a 120 and finally with a lap or disk charged with 220 abrasive. Experiments indicate that these give very satisfactory results. It is felt that the fact that these alloy tools can be ground in the average shop with a little care as to equipment and methods gives them a great advantage over the diamond for many kinds of work, as in most applications the diamond must be sent away periodically for grinding or dressing.

The grinding of tungsten-carbide tools, however, is too costly to be left to the tender mercies of the average machine operator, and this fact should tend to make the central or tool room grinding system universal. With proper equipment that includes wheels with as many sizes of abrasives as may be necessary, the grinding of new tools need not be difficult, and standardization of tool shapes should be made easier.

Laboratory Ball Mill Possesses Unusual Features

SIMPLICITY of construction and rapid performance are the outstanding features of a new laboratory ball mill which is particularly suited to installations where a large number of tests must be made within a limited period. The mill is supported and pivoted between the forks of a yoke, and this entire unit is mounted on a shaft supported by two bearings. A fixed and a loose pulley are arranged between the bearings for belt drive. In the running position the mill is clamped by means of a handwheel. In charging and discharging operations, the mill is unclamped, which permits it to swing

New laboratory ball mill



freely between the forks of the yoke, as indicated in the accompanying sketches. Diameter of the mill is sufficiently large so that with a full charge it does not spill. Pan-American Engineering Corporation, of San Francisco, manufactures the ball mill.

Pneumatic Trip Stop Grips Car Wheels

A PROBLEM arose of calculating the matic car retarder and stop is installed at the load end of the rotary dump at a Pennsylvania property. The design of this device, as described by *Coal Age*, consists merely of two heavy and reinforced angle irons which are so actuated as to grip the car wheels by pressing them against elevated wheel guides.

As shown in the accompanying illustration, the gripping motion of the angle irons is imparted through toggles

A quick car stop

on the upper end of vertical shafts. These vertical shafts are carried in steel sleepers to which the elevated wheel guides are anchored. To the lower end of these shafts are keyed stiff arms which are connected to the plunger of an air cylinder. When the plunger moves in or out, it causes the vertical shafts to turn, thus operating the toggles to tighten or release the angle-iron wheel grips.

Estimating a Dust Loss

A PROBLEM arose of calculating the amount of dust escaping from a plant grinding over 100 tons of clay per day, which had to be air separated, writes H. Spurrier in *The Chemist-Analyst*. A fan exhausted 10,000 cu.ft. of air per minute, and with that air much impalpably fine clay dust escaped, which constituted a great nuisance. In installing a new dust collector it became necessary to determine, if possible, the amount of dust discharged. Engineers' estimates, which varied by several hundred per cent, did not constitute reliable data.

The large amount of dust and the velocity of discharge precluded the use of any of the usual methods. Accordingly, the following plan was devised: A 5-gal. drinking fountain bottle was calibrated, and a 1¼-in. hole was made in the bottom as follows: A piece of soft brass tube 1⅛-in. in diameter and 2 in. long was cut, and in one end was firmly soldered a snugly fitting piece of machine steel, turned down so as to form a shank that could be held in a drill-press chuck. A wad of waste was forced into the large bottle, to cushion the fall of the piece cut out. It was then turned bottom end up and packed securely in its own shipping crate. A strip of sheet zinc was rolled into a collar, ¼ in. high and 2 in. in diameter, which was puttied, by means of dry clay and linseed oil, around the desired position of the hole, so as to form a small reservoir, into which was poured a mixture of 120-mesh carborundum and water.

The table of the drill press was swung aside and the crated bottle placed on the base plate of the press. The boring tool above described was mounted in the chuck, turned about 60 r.p.m. Gentle and intermittent contact of the tool and work was made, so as to bed the grains of carborundum into the brass tube.

It is necessary frequently to raise the tool a little, so as to admit fresh carborundum into the "cut," but it is surprising how fast the cutting is. Toward the end of the cut pressure must be light, to avoid breaking too much of the glass at the last moment.

The core of glass measured 1¼ in. diameter and was ⅛ in. thick. The bottle was made scrupulously clean inside and a new rubber stopper, fitted with an iron-rod handle secured by a nut and washer above and below, was inserted in the mouth.

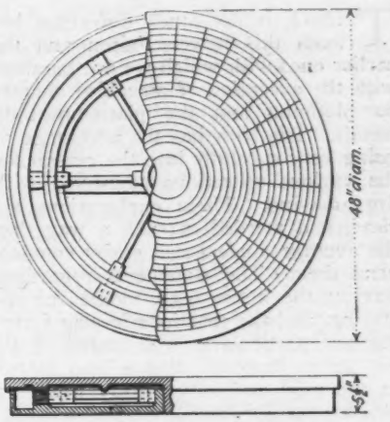
In the hole in the bottom was firmly inserted a two-hole rubber stopper fitted with glass tubes and rubber tube connections furnished with stout screw cocks, to connect one with the vacuum pump and the other with a suction mercury column; in this way the degree of vacuity achieved was measured. By reference to the barometer reading, the percentage of vacuity could be calculated, and, therefore, the amount of air removed.

The exhausted bottle was now held by two men mouth end toward and about 6 ft. from the fan, and the stopper was suddenly removed and replaced. In this way a good sample of the fan exhaust was secured.

It now remained thoroughly to wash out the contents of the bottle, evaporate the washings to dryness in a weighed platinum dish, and weigh the residue. From the known percentage vacuity and the capacity of the bottle the volume of sample taken could be calculated. From the amount of clay dust in the sample, and the known volume discharge of the fan, the amount of dust discharged per hour was readily ascertained. Triplicate tests varied to no greater a degree than the probable variability of the fan itself.

New Turntable Speeds Caging of Cars

PROVISION has been made by the Wright-Hargreaves Gold Mines, at Kirkland Lake, to insure the efficient handling of cars in its underground stations. Formerly the tracks were carried directly into the stations in the customary manner and turntables of the ordinary type with rails on their upper surface were employed. This has been



Use of this simple turntable has speeded the caging of cars

abolished, however, and the station floor is now covered with ¼-in. steel plate. This thickness has been found better than either ⅜ in. or ½ in. The plate is laid on two ply of 2-in. plank crossed, which is well tamped and spiked together. Formerly the company tried laying the steel on a cement foundation. However, this was not as satisfactory as the timber. Some trouble is experienced from the buckling of the plate. This cannot be avoided, apparently, but experience has shown that it does little harm.

The mine track in the drift or crosscut is carried past the station and not into it as before. At the entrance to the station, directly in the middle, a turntable, such as that shown in the accompanying illustration, is placed. This turntable is made by the Wabi Iron Works, New Liskeard, Ont., and is used by other companies besides the one mentioned.

As the reader will note from the drawing, the turntable has no rails on its upper surface, but instead has simply a smooth sheet. The ends of the rails of the track abutting on the turntable from the two opposite directions have the web and flange cut away, so that the crown of the rail projects over onto the turntable. These projections are bent inward toward the center of the track. The turntable, being mounted on rollers, can be rotated easily. This fact, plus the facility with which the cars can be moved on the steel-plate flooring of the station, made it possible to cage as high as 600 cars in two shifts, prior to the adoption of skip hoisting.

Book Reviews

For Students and Assayers

MANUAL OF FIRE ASSAYING. *By C. H. Fulton and W. J. Sharwood. Third edition. New York; McGraw-Hill Book Company. Pp.268;illus. Price $3.*

THERE is not much difference between this newer Fulton and the earlier ones with which we are familiar, with the exception of an added chapter on platinum and the platinum-group metals. The book has the advantage of going very carefully into the reason for the various operations connected with fire assaying. These explanations are clear, and worded in such a way that the average student can easily comprehend them. The statements regarding fluxing, the fluxes used, method of operating, and the reactions in slag forming are particularly well stated. I do not agree, however, that a lead button in the gold and silver assay need not weigh over 20 grams; we find a larger button advisable on California gold ores. In general, the book gives a clear, complete and concise résumé of the fire assay for gold and silver.

Fire assays of tin, lead, copper, and antimony are obsolete and are not recognized as accurate by assayers today. A combination assay for bismuth, in which the first reduction is by fire, is often desirable. The fire assay of mercury is the accepted method, at least on the Pacific Coast. The newer chapter, covering the assay of ores for platinum, iridium, and gold and silver, is largely taken from the paper of Davis, of the U. S. Bureau of Mines, which is probably the latest and best authority on these particular tests. Due credit is given to the Davis paper. In general the work is to be commended and will still be valuable, as the earlier editions were, to the student of gold and silver methods of assaying.

ABBOT A. HANKS.

GEOLOGY AND MINERAL RESOURCES OF KENTUCKY. *By Willard R. Jillson, State Geologist. Frankfort, Ky.: Kentucky Geological Survey. Pp. 400. Free.*

IN THIS new volume each county is described separately and in alphabetical order, with the areal extent of each indicated early in the discussion. The physiography, or character of the earth's surface, is followed by a brief description of the structural geology or attitude of the rocks as they occur in each locality. A summary of the stratigraphy—the kind of rock and its areal extent—then follows.

The mineral resources are given in detail, with every resource in each county mentioned and the output and value of the more important ones enumerated. The frontispiece is a colored plate of fluorite specimens obtained in the western part of the state. Scattered throughout the back are 250 other photographs, maps, and diagrams adequately illustrating the features discussed, which provide information concerning the geology, natural features, and earth resources of the Commonwealth of Kentucky.

FORTY YEARS WITH GENERAL ELECTRIC. *By John T. Broderick, Fort Orange Press, Albany, N. Y. Pp. 218. Price $2.50.*

AT THE outset the author makes haste to inform the reader that the task of preparing this series of sketches was undertaken upon his own initiative. Otherwise the title might possibly mislead. That an employee of this company, however, who has been with it almost since its start, should be inspired to set down his reminiscences of the remarkable men with whom he has been in contact is not surprising. In the company's achievements and wonderful growth all can find inspiration.

Official or otherwise as a chronicle, the book is worth reading, if on no other ground than that of being interesting. Mr. Broderick writes well. His theme is the spirit of General Electric, and, with the aid of anecdote and detail, he succeeds in making his reader feel the existence of a noteworthy spirit. Although it is rather trite to say that the history of a company is the history of the men who have helped in building it, one readily perceives in running through these pages that the association in one enterprise of men like Thomson, Coffin, and Rice with such gifted researchers as Whitney, Coolidge, and Langmuir, and, in a class by himself, Steinmetz, could not have failed to produce usual results. One is tempted to wonder how different would these results have been had the great laboratory for research at Schenectady never been established.

THE MINERAL INDUSTRY, 1928, VOL. XXXVII, *Edited by G. A. Roush. New York: McGraw-Hill Book Company. Pp. 802. Price $12.*

To improve this valuable reference work in any marked degree would be difficult for its editor. The new volume is slightly larger than its immediate predecessor, and a few changes are noted in the list of contributors. The newcomers among the latter and their topics are: C. L. Mantell, "Aluminum and Bauxite"; Paul M. Tyler, "Arsenic"; Homar L. Johnson, "Copper"; H. N. Lawrie, "Gold and Silver"; Sidney G. Koon, "Iron and Steel"; and H. S. Spence, "Mica." The section on gold and silver is considerably shorter than that of last year; whereas Mr. Koon's contribution on iron and steel, that of Mr. Spence (of the Dominion Department of Mines, Ottawa) on mica, and that of Professors Richards and Locke, on the progress of ore dressing and coal preparation, are longer.

AMERICAN IRON AND STEEL INSTITUTE ANNUAL STATISTICAL REPORT FOR 1928. *Published by the Institute, 75 West St., New York. Pp. 120.*

Beyond announcing the appearance of an annually issued volume of this sort, nothing can be said, unless it be to broadcast the contents. The figures are dry, however, unless interpreted, and therefore the editor contents himself with stating that the important statistics of the iron and steel industry are to be found within its covers. The report is the operators' official reference book.

KÖGLER, TASCHENBUCH FÜR BERG U. HÜTTENLEUTE. *Wilhelm Ernst & Sohn, Berlin. Pp. 1,207. Price, linen, 33½ marks. Leather, 36½ marks.*

THIS VOLUME is a reference work for practicing engineers in mining and metallurgy. Its purpose is to orient the engineer quickly when he enters upon a new division of the field, and to give him the fundamental principles and approximate figures for his sketches and decisions. Each of the 35 divisions treated by the book has been written by an experienced specialist in that field, and, as is usual in German publications of the sort, many of them are professors at the universities. Especial pains are taken to give performances and costs for each operation. This feature is of some value to American readers for making comparisons. Although the usual German thoroughness is in evidence, the treatment has been concentrated upon the most essential elements.

To the technique of mining engineering are devoted nearly one thousand pages, leaving about two hundred for metallurgy. In addition to the chapters on mining practice, two chapters deal with the economic and legal phases of mining, one chapter discusses the elements of electrical engineering, two chapters are devoted to assaying and blowpipe analysis, and one chapter is concerned with briquetting. The text is well illustrated.

The part dealing with metallurgy is concerned with operating conditions in the extractive processes for copper, lead, zinc, silver, and gold, and the other non-ferrous metals. There is a chapter on electric-metallurgy and one on light alloys. The volume will be a useful book for comparing American practice and for obtaining certain details not given in American handbooks.

GILBERT E. DOAN.

Personal Notes

E. J. MEHREN

E. J. Mehren, of Chicago, vice-president of the McGraw-Hill Publishing Company, Inc., has been appointed chairman of a national committee to study traffic congestion. This committee will continue the work of the national conference on street and highway traffic, in coping with one of the foremost problems before the country today.

Owen Letcher returns to South Africa from London on Oct. 12.

O. A. McCraney is now general superintendent of the Murchie property near Nevada City, Calif.

C. Colcock Jones has returned to Los Angeles from mine examinations in Mono County, Calif.

John B. Huttl is returning to New York City on the "Aquitania," sailing from Cherbourg on Oct. 12.

G. M. Wasteneys, general manager of El Oro Mining & Railway, has returned from a business trip to London.

Col. **Percy E. Barbour,** of New York City, recently returned from a professional trip to New Mexico and Nevada.

B. S. Butler, of the U. S. Geological Survey, has completed his season's field work in Colorado, and returned to the University of Arizona.

W. A. RuKeyser, technical consultant to the U.S.S.R. asbestos trust, left Moscow early in September for Sverdlorsk and Bashenova, in the Urals.

Nicholas J. Pullus, mechanical engineer for the Chosen Syndicate, operating in Korea, has resigned from the company, and has returned to San Francisco.

P. M. Shelby, who has been in charge at the B. & B. Quicksilver Company's mine and plant in the Fish Lake Valley, west of Tonopah, Nev., has been succeeded by **E. J. Bumstead.**

G. S. Brooks, general manager of Giesche Spoka Akcyjna, at Katowice, Poland, an Anaconda subsidiary, has been elected a vice-president of the Silesian American Corporation.

O. W. Judd, general manager of the Jumbo Lead Mines, Inc., of Florence, Ariz., has been elected president of that company. **Fletcher Merrill,** mine superintendent, has become a director.

Dr. **W. J. Wright** has been appointed mineralogist for the province of New Brunswick, and will assume his duties on Oct. 1. Doctor Wright has spent the last few years doing special work in oil geology.

Hugh Rose, manager of the Camp Bird interests in Mexico, including the Mexican Corporation and Santa Gertrudis, is en route to Australia, to inspect the company's interests in that country.

Thomas C. Baker, until recently general manager of the Fresnillo unit of the Mexican Corporation, sails on Oct. 2, from San Francisco to take charge of a new mining property in New South Wales, Australia.

Dr. **E. L. Bruce,** recently on the staff of Ventures, Ltd., in northern Manitoba and northern Saskatchewan, has returned to Queen's University to take up the duties of the Miller Memorial Chair in geology.

Fred W. Nobs, former superintendent of the Empire mine, has been appointed general manager of the Empire-Star Mines, at Grass Valley, Calif. George Kerwin, the former manager, has been assigned to African properties.

Harry S. Thayer, of Colorado Springs, Colo., is in New York City arranging finances for Crater Mines, Inc. Mr. Thayer is president of the company, which is operating in Custer County, Idaho. His address is the Engineers' Club.

Sir **Ernest Oppenheimer,** of Johannesburg, chairman of the board of directors of the Anglo-American Corporation, will be in London in October, and soon after his arrival, **Carl Davis,** technical director of the organization, will pay a visit to South Africa.

C. W. Hall, vice-president of the United Clay Mines Corporation, left Trenton, N. J., recently, in company with **Paul B. Johnson,** mining engineer, of Milwaukee, Wis., for an inspection tour of clay-mining properties in South Carolina and Florida.

George H. Garrey has just completed a joint geological examination for the Sloan-Amethyst Leasing Company, the P. & E. Leasing Company, and the Reynolds-Morse Corporation, of the area in the vicinity of the Pittsburgh, Amethyst, and Del Monte claims, at Creede, Colo.

George P. Hulst, for many years superintendent of the American Smelting & Refining Company's plant at Omaha, and later superintendent of the International Lead Refinery at East Chicago, has been appointed superintendent of the American Lead Company's plant at Indianapolis.

OBITUARY

Harmer C. Sandifer, British mining engineer, died on Sept. 16, at the Lady Cowdray Hospital, Mexico City. Mr. Sandifer was 73 years of age, and had been in Mexico for the last 40 years.

An Appreciation of Homar Lincoln Johnson

Homar Lincoln Johnson and his wife, Louise Barnes Johnson, were the victims of a tragic accident which occurred near Fairfax, Va., at 5:30 p.m. on Sept. 17. The roadster in which Mr. and Mrs. Johnson and their young son were driving skidded while descending a hill in the rain, crashing into a telephone pole. Mr. Johnson was instantly killed and his wife made unconscious from injuries which resulted in her death four days later. Their son, Homar, five years old, was thrown some distance from the car, but was uninjured and gave full information regarding the identity of his parents and relatives. The family was on the way back to New York from a vacation spent with Mr. Johnson's parents in Athens, Ohio, who came as soon as possible and took charge of the small boy.

"Jake" Johnson, a graduate of the Colorado School of Mines in 1925, came with the *E.&M.J.* as assistant editor in January, 1928, being selected from over 40 applicants for the position, a selection that was always regarded as fortunate. At that time a former employer wired us, "Homar Johnson has good personality, reliable conscientious worker, level headed, very apt." That estimate of him was an understatement. He soon became one of the most valued members of the staff, his keen comprehension being especially valuable in the market work to which much of his time was devoted. About three months ago he accepted a responsible position with the New York headquarters of the A.I.M.E., though part of his time was still devoted temporarily to the *E.&M.J.* market work.

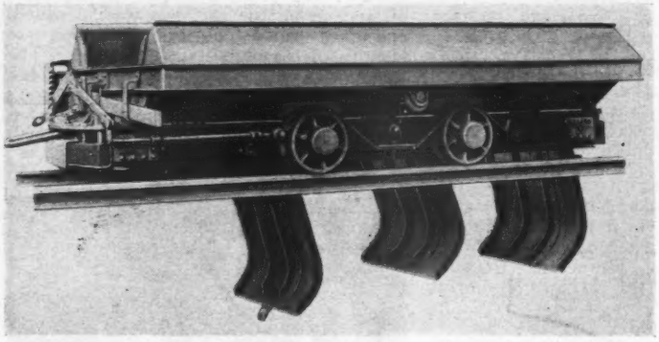
In the year and a half that I was privileged to know him, both in the office and at home, he measured up to the highest standards of manhood, and his death is an acute personal loss. His young son, though robbed of a future with his parents, is left with the memory of a devoted father and an equally devoted and charming mother, who counted no effort too great to secure his well-being. In this early influence of a delightful home, the son of Homar Johnson has a rich heritage.

EDWARD H. ROBIE.

INDUSTRIAL PROGRESS

Something New in Shovel Design— Another Automatic Dump Car— Numerous Other Developments

EQUIPMENT of interest to mine and mill operators, that has been recently introduced, includes a new automatic-dump car, a new type of electric shovel, and a light, all-purpose rock drill.



New automatic dump car having unusual capacity for its dimensions

A "Double-Automatic" Mine Car

Another bottom-dumping car has been added to its line by the Sanford-Day Iron Works, Inc., Knoxville, Tenn. The cars built by this company for the Birmingham Slag Company and for the Nevada Consolidated Copper Company have already been described in these pages. The new car, known as "Double-Automatic," has the same patented principle of automatically opening and closing the bottom doors as the company's Griffith Standard "Automatic," with an additional feature in that the side sections which extend out over the wheels are so hinged to the frame channel that they raise and discharge their part of the load through the bottom also. In this way is obtained the maximum capacity possible in any type of car of the same over-all dimensions. In fact, this car is said to have greater capacity than cars of other types, because the drop-bottom doors curve down below the axles, adding materially to the capacity, and because the lading bottom of the side sections is below the top of the wheel, this also giving extra capacity.

In the standard car, the sides slope toward the center so that the coal will shed when the bottom doors are open. In the new car, here described, in order to get the extra capacity, the sloping sides have been done away with, and the side sections built so that they are hinged to the channel frame of the car. The bottom of these side sections extends out horizontally over the wheels and then bends at right angles and extends up vertically to the top of the channels of the car, making a rectangular bed, except for the curvature of the bottom doors. These side sections have their floor level below the top of the wheels, and openings, covered with hoods or shrouds, are made in them so that the wheels extend up into the body of the car.

Dumping is simple. As the train moves across the storage bin, a tripping device alongside of the track comes in contact with a latch lever on each car, causing the bottom doors to open and discharge the central part of the load. When the train moves across the bin, a roller on the side of each car comes into contact with the upward-sloping surface of another device alongside of the track and is thereby forced upward, causing the sides to tilt to the proper angle for dumping their contents through the bottom of the car also. As the train proceeds, a door-closing device (a knuckle in the center of the track at the other end of the bin) closes the bottom doors, and the sides automatically lower as the roller rides down the now downward-sloping surface of the device which caused it to raise the sides in the first place.

By means of these devices, in one continuous operation without stopping or uncoupling, the motorman and trip rider are able to dump 20 to 30 cars per minute.

Something New in Shovel Design

Up to 1910, the railroad type shovel was supreme in the power excavating field. But as mining developed and new economic obstacles were met, development of a larger excavator became necessary in order to reduce unit cost. The answer was the large, full-revolving excavators, having great range and capacity, the first of which was built and shipped by the Marion Steam Shovel Company in 1911.

Recently, economic conditions have raised new problems in several fields, particularly in iron-mining operations, with the result that a trend has developed toward an entirely different type of shovel, one of large capacity and low maintenance cost.

The large "strippers" will undoubtedly continue to be needed for material that may be immediately "spoiled." For this, they are superior to any other type. But where speed, high capacity, accuracy of loading and ease of handling enter, they are too large and cumbersome. Their bulk and range are a hindrance rather than a help in loading ore cars, separating ores, and the like. Much skill is required and much "plugging" of the swing and crowd to spot the dipper over car, and in this manner time is wasted. These huge excavators are unwieldy in the pit, and where formations require "sorting" of different grades they are also at a disadvantage.

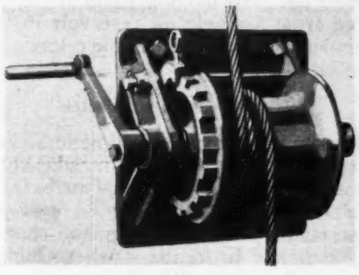
To perform with facility the operations mentioned in the foregoing, and yet retain a higher capacity, a new Marion shovel (Type 6200) has been designed. This new excavator, one of which is shown under construction in the accompanying cut, is intended to be extremely fast and yet always under the operator's control; to be quickly movable in the pit, and at the same time have sufficient range to avoid the necessity of being moved frequently.

The first of the new Model 6200 shovels under construction in the shops

Speed has been obtained in two ways:

First, by using a minimum of rotating parts. Only the boom, dipper and handle, and hoist machinery rotate, as compared with the full-revolving machine. Second—and this is an important innovation over the railroad type—the entire hoisting unit is mounted on the swing circle, eliminating the old chain hoist with its accompanying sheaves. Not only does this design permit rapid hoisting and fast swinging, but, by reason of the low inertia, allows easy control and spotting. Inasmuch as rotating and hoisting are the major operations to be performed, the operating cycle has been speeded up by 20 per cent as compared with even the 4-yd. machines.

By combining this speed of operation with a large dipper, increased capacity has been obtained. The new shovel will have a 5-yd. dipper as standard. This will permit "grading" of the ore or other material in the pit. It is small enough to permit fast and efficient operation and yet sufficiently large to assure the high capacity for which the machine has been designed.

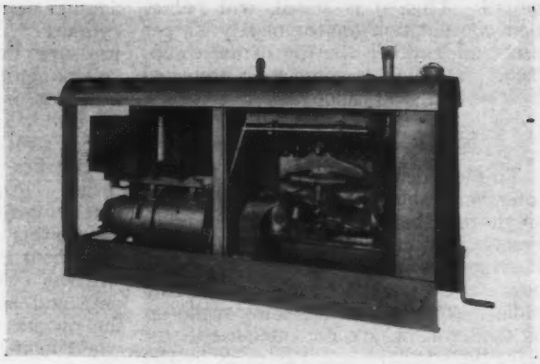


A fast-acting hand winch

Another improvement over the railroad type is found in the crawling traction equipment and propelling machinery. Heretofore, excavators have depended on the hoist machinery for motive power in propelling. The new shovel is equipped with an entirely separate propelling unit mounted rigidly on the lower frame (as distinguished from the swinging circle) and under separate control. Power from the motor is conveyed through a gear train to two semi-rigid crawlers. These have a three-point bearing to allow for inequalities of the pit floor, but are otherwise similar to the efficient rigid crawlers of the small revolving shovels. The object of this design is to permit ease of handling in the pit, a short turning radius and faster propelling. The shovel will be able to move about in pits in which a large, full revolving shovel could not be taken.

Because of these improvements in design it has been possible to give this new shovel a much larger swinging arc than could be used on the railroad types. The swing now possible is no less than 220 deg., which will permit digging or loading far back of the center line of rotation, so that three ore cars can be loaded at a time without re-spotting.

As a result of all these features, the new 5-yd. shovel will have an output almost 50 per cent larger than that of the 4-yd. shovel, which has recently been considered most suitable for this type of work, because of the drawbacks of the large stripper shovel.



A fuel-saving device features this gas-engine-driven welder

Hand Power Winch Fast

A new winch designed for fast action in raising and lowering counterweighted chutes, spouts, gates, and doors has been designed by Stephens-Adamson Manufacturing Company, Aurora, Ill. With it one man can easily raise or lower loads up to 60 lb., at a speed of about 50-ft. per minute, according to the manufacturer. It can be operated in either direction and is equipped with a positive safety pawl which engages to hold the drum from rotating backward or forward. The machine has a flanged 5-in. diameter drum, which rotates in a sturdy cast frame and is driven directly by a hand crank without worms or gears.

A New Shop Tool

Another portable tool, an electric drill, has been announced by the Wodack Electric Tool Corporation, 4627 West Huron St., Chicago. It is said to be light and strong and to have a wide range of application. It is powered with a G-E motor which is built in for d.c- or a.c. of 60 cycles or less, 110-125 or 220-250 volts, as desired. The drill is provided with an oversize double-pole trigger switch.

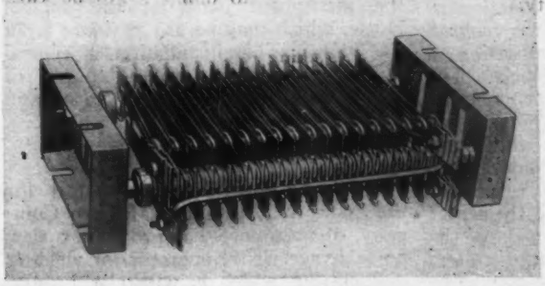
This Resistor Is Unbreakable

A new unbreakable resistor, known as "Dur-ristor" has been announced by Cutler-Hammer, Inc., Milwaukee. This new resistor has a constant resistance element and is designed to give maximum service under severe operating conditions. Besides being unbreakable, it is also vibration-proof, non-corrodible, light, and compact. It is shown in one of the accompanying cuts. The resistance element consists of two continuous unbreakable strips which are of rust-proof, non-corrodible alloy. They are proportionally ribbed on the sides as well as on the turning edges. The strips are supported in a new way, which, combined with the ribbing, permits the strips to expand and contract freely during changes of temperature. The entire resistor is made unbreakable and permanent by eliminating all brittle material and by using mica for all insulation. All resistors of this type, regardless of ampere rating, are of equal size. The thickness of the resistance strip is the only part that varies in size—that is, according to ampere rating.

Another electric shop tool having wide application

Another New Welder

For use where electric power is not available, the Lincoln Electric Company, of Cleveland, has introduced a new model of gas-engine-driven welder. This is of 200 amp. N.E.M.A. rating and is driven by a four-cylinder Waukesha engine operating at 1,500 r.p.m. Features of design include an automatic idling device which automatically reduces or accelerates the speed as re-



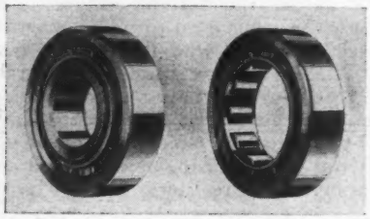
Unbreakable, vibration-proof, non-corrodible—this new resistor is said to have all these qualities

quired. This, it is stated, will reduce fuel consumption approximately 25 per cent and lengthen the life of the equipment. The unit is completely protected by a welded steel canopy.

New Radial Roller Bearings

To meet demand for a roller bearing interchangeable with standard S.A.E. single-row ball bearings, but having greater load capacity, the Hyatt Roller Bearing Company, Newark, N. J., is now also manufacturing single-row radial bearings. These, being made up of solid rollers, are not intended to replace the standard bearings made by the company, in the manufacture of which spirally wound rollers are used, but are offered to supplement them, for positions where space is limited and loads beyond the capacity of ball bearings must be sustained.

The design is such that the rollers are



New roller bearing, with and without inner race

permanently retained with the outer race, the inner race being separable. A separator, floating on the rollers, spaces them properly, and heat-treated end rings retain them endwise within the outer race. By this means the rollers are kept in proper alignment, insuring positive contact along their full length. Rollers and races are made of a special chrome-nickel steel, and the end rings of vanadium steel. The new bearings are interchangeable, with all single-roll ball bearings of equivalent sizes.

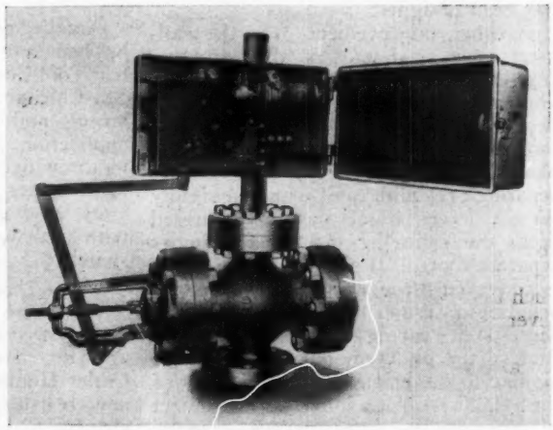
An Air Motor of New Design

A new principle of operation is embodied in the Hele-Shaw Beacham air motor, which has been designed for haulage and portable centrifugal pumps underground. In its construction three or four cylinders are cast *en bloc*, which rotate on roller bearings around a fixed central valve. Through the latter the air is distributed to the cylinders and the exhaust escapes. The arrangement of ports is the same as in an engine operating on the rotary instead of the slide-valve principle. However, instead of the valve revolving, it is stationary and the cylinder block revolves instead.

Ingenuity is used in imparting a rotary movement to the block: The pistons are not equipped with connecting rods, but end at the gudgeon pins, which are equipped with rollers which are always connected with an outer fixed ring, which is eccentric with respect to the cylinder block. Therefore, the center of the block is closer to one side of the outer ring, against which the rollers rest. It is at this point that the valve arrangement allows air to enter the cylinder. The expanding air exerts pressure through the piston and the rollers against the outer ring, which is, however, immovable. This ring being off center and not perpendicular to the thrust, a rotary movement of the cylinder block takes place and continues until the thrust is exhausted at the point of the outer ring furthest from the block center. Before this happens, however, the rotary movement of the block has brought the working cylinder around to the exhaust port and has also brought another of the cylinders around to the inlet port, whereupon the cycle is repeated. This makes it possible to produce a motor of high power relative to its size and weight.

Measuring Flow Under Unusual Conditions

Accurate measurement of flow at high temperatures and high pressures is necessary in some plants. Automatic control of flow under these conditions, although desirable at times, further complicates the manufacture of flow-metering equipment. Nevertheless, some successful installations of this character have been made by the Brown Instrument Company, Philadelphia. In them have been used the company's forged steel manometer together with its electric flow meter, which operates on the inductance bridge principle, the purpose being to govern specially constructed remote control valves. The valve, shown in one of the accompanying cuts, is used in one of these installations. It is designed to control automatically the feeding of hot oil to a petroleum cracking still and is built to operate at 1,300 lb. pressure and 600 deg. F. temperature. It is controlled by the setting of an automatic control flow recorder, on the instrument panel of the control house, which may be any distance from the valve. This installation is typical of many applications to the control of steam, water, process liquors, gases, and the like.



This valve is electrically equipped to control and measure flow automatically at high temperature and high pressure

Acetylene Generator Improved

By using drawn seamless steel for the body, the Alexander Milburn Company, of Baltimore, has produced a new portable acetylene generator for welding and cutting which is naturally lighter, stronger, and more dependable than generators having bodies with the usual joints. It may be had in three sizes, 35, 70, and 100 lb. capacity. It is simple in design, has no clocks or motors, and only a few moving parts. Control and operation are simple.

A Light, All-Purpose Drill

A new model (No. 11) rock drill is now being produced by the Gardner-Denver Company, Denver, Colo. It is a light, all-purpose machine intended for either wet or dry drilling, weighs only 50 lb., and has a drilling speed equal to that of heavier machines, according to the manufacturer. The drill may be mounted for light drifting, or on a tripod, or for channeling on a quarry bar. It requires $\frac{7}{8}$-in. to 1-in. steel. For keeping the hole clean ordinarily, a strong air current is sent through the steel. When drilling unusually deep holes, a special blowing device can be turned on. All moving parts are lubricated from a single oil reservoir in the cylinder. If desired, air line oilers may also be used.

A Safety Magnetic Switch

A new oil-immersed magnetic switch of small capacity has been introduced by General Electric. It is said to be particularly suitable for use in gaseous atmospheres such as powder and chemical plants, or in locations where highly corrosive gases or acids are encountered. It is designated as CR-7006-V-7.

The switch is of 40 amp. capacity and can be used with any motor, from 110 to 600 volts, the full-load current of which does not exceed the value given. Contactor and interlock are standard in design. The overload relay used has oil-immersed contact tips in which the heaters are located above the oil level. The relay is reset from the top of the oil tank.

For Cleaning Belt Conveyors

To remove dirt from the underside of conveyor belts a rubber squeegee has been developed by the Robins Conveying Belt Company, New York. It consists of a series of spiral flutes of high-grade rubber. The roll is $7\frac{1}{2}$ in. in outside diameter and is made up in 6-in.

sections, mounted on a wooden core. The wearing part is about ¾-in. deep. This cleaner is intended to be mounted on the same driving mechanism as now used on the brush cleaners made by the company. It turns with a peripheral speed of 1,000 f.p.m. The spiral shape of the flutes is said to prevent the belt from flopping up and down. By placing the cleaner far enough back of the head pulley so that the belt is straightened out from its crowning over the pulley, the entire width of the belt can be cleaned effectively. The squeegee is said to bear very lightly against the belt, thus preserving its own life and that of the belt. It will give at least 1,000 hours of service, according to the manufacturer.

Better Switches for Crane Cabs

General Electric has announced a new type of operating mechanism for use with drum switches mounted in crane cabs and similar places. This supersedes the rack-and-pinion underlever type, eliminates the trouble experienced in keeping a perfect line-up between the shaft of the operating mechanism and the drum-switch shaft, and makes it possible to inclose the mechanism to keep dirt from the gear lubricant. The mechanism consists of a pinion on an extended drum switch shaft, meshing with a segment gear, all housed in a dust-tight cast case provided with a hole for gear slushing and with a short lever arm projecting below the case. The lever arm can be connected with the reach rod in the same way as with the old rack-and-pinion type.

Advantages of the new mechanism are: The operating lever may be located in other normal "off" positions than the position at right angles to the conventional center line of the switch, if this is required by the peculiarities of the application. Lesser intermediate variations may be obtained by changing the mesh of the gear teeth. The inclosure is practically dust-proof. By the use of oilless bearing bushings the question of bearing-lubrication is disposed of. There are no keys, pins or setscrews to work loose and introduce play or backlash. Moreover, the gear ratio is such that the movement of the operating lever is very nearly a straight line for the reach rod and is laid out to give a linear travel equal to that in older designs.

Treated Factory Sash

Factory sash impregnated with Wolman salts is now being marketed by the American Wolmanized Lumber Company, Elizabeth, N. J. It is recommended by the producer for severe rot-producing conditions. Treated with these salts under vacuum and pressure, the manufacturer claims that the sash will outlive untreated sash at least three times.

In ordinary sash, rot attacks first the weakest spots, the joints. Failure at these points has been guarded against by injecting a double amount of preservative, not only into mortise and tenon but throughout the sash. A fifteen-year guarantee is given against failure because of fungus decay. Impregnation does not in any way change the natural characteristics of the wood other than to eliminate the hazard of decay. Treated work can be painted and handled the same as untreated wood.

Another New Clamshell Bucket

A new digging bucket that can be adjusted for the kind of material being dug has been designed by the Erie Steel Construction Company, Erie, Pa. It is known as the "Multi-Power" from its working action, a combination of the multiple rope and lever arm principles. The bucket can be rigged up with 2, 3, 4, 5, or 6 parts of line. The scoops are said to be oversize with but little added bucket weight. Counterweights in 100-lb. units can be added by one man. These are attached to the bucket by two bolts and can be put on or removed quickly. The teeth are of the self-burying chisel-point type.

A Better Box-Header Boiler

Single-seam construction for its box header boilers of both the Heine and Walsh-Weidner types has been developed by Combustion Engineering Corporation, New York. The two sheets comprising each header are joined with a single seam and by a single row of rivets, thus eliminating butt straps for connecting the tube and handhole sheets. The new design is simple, stronger and provides a higher safety factor, according to the company.

BULLETINS

PUMPING—Elliott Company, Pittsburgh, Pa. Bulletin A-4 entitled "Strainers."

COMPRESSORS—De Laval Steam Turbine Company, Trenton, N. J. Catalog on centrifugal compressors and blowers.

SAND PUMPS—A. R. Wilfley & Sons, Inc., Denver, Colo. Catalog No. 7 on centrifugal sand pump.

MOTORS—U. S. Electrical Mfg. Co., 200 East Slauson Avenue, Los Angeles. Catalog No. 29. The story of U. S. Motors.

POWER TRANSMISSION—Simplex Wire & Cable Company, 201 Devonshire St., Boston. Booklet on Fibrex tree wire.

POWER TRANSMISSION—Simplex Wire & Cable Company, 201 Devonshire St., Boston. Booklet on Condex park cable.

ARC-WELDING SCHOOL—General Electric Company, Schenectady, N. Y. Bulletin No. GEA-1125.

OIL BURNERS—Combustion Engineering Corporation, 200 Madison Avenue, New York City. Catalog on Quinn oil burning equipment.

VERTICAL MOTORS—Wagner Electric Corporation, 6,400 Plymouth Avenue, St. Louis, Mo. Bulletin No. 159 covers all types of large vertical motors.

BOILERS—Erie City Iron Works, Erie, Pa. Two booklets, one covering the three-drum boiler and one describing and illustrating their Economic boiler.

COMPRESSORS—General Electric Company, Schenectady, N. Y. Bulletin No. GEA-1118. Two-stage reciprocating air compressors, types CP, CPQ, and CPT-26.

HEATING — American Blower Corporation, 6000 Russell St., Detroit. Bulletin No. 7818, describing the Venturafin method of unit heating.

DREDGES—Yuba Manufacturing Company, 351 California Street, San Francisco. Book entitled "Gold Dredges" prepared by Samuel P. Johnson.

ROCK CRUSHING PLANTS — Allis-Chalmers Manufacturing Company, Milwaukee, Wis. Spanish publication No. 1464-S on modern rock crushing plants.

WELDING — Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Leaflet No. 20421. Multiple operator arc welding equipment.

MOTORS—Wagner Electric Corporation, 6400 Plymouth Avenue, St. Louis, Mo. Bulletin No. 165, describing seven types of squirrel-cage motors.

FLOODLIGHTS — Crouse-Hinds Company, Syracuse, N. Y. Bulletin No. 2136. Type ADA floodlight.

METALLURGICAL DATA — The General Engineering Company, Inc., 159 Pierpont Avenue, Salt Lake City, Utah. Metallurgical Bulletin.

COMPRESSOR — General Electric Company, Schenectady, N. Y. Bulletin No. GEA-1120. Reciprocating air-compressor sets, two-stage, stationary.

PULVERIZED FUEL — Combustion Engineering Corporation, 200 Madison Avenue, New York City. Reprint entitled "Operating Experiences Proves Pulverized Lignite a Satisfactory Fuel," by V. H. Braunig.

MOTOR GENERATORS—Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Leaflet No. 3746-E, synchronous motor generators.

BLOWERS—The Connersville Blower Company, Connersville, Ind. Bulletin No. 201. Exhausters for more dependable and economical service.

RECORDING INSTRUMENTS — The Bristol Company, Waterbury, Conn. Catalog No. 2,100 on the subject of recording psychrometers.

MOTORS—Elliott Company, Jeannette, Pa. Bulletin No. L-2 describing 3,550 r.p.m. induction motors.

BLOWERS — The Connersville Blower Company, Connersville, Ind. Bulletin No. 110, describing their "R-S" and "R-B" series of rotary positive blowers suitable for the medium range of air volumes and pressures.

AMMETERS—Roller-Smith Company, 233 Broadway, New York City. Bulletin No. 810, covering its types TW, FW and STW thermo-couple ammeters and milli-ammeters for direct current and alternating current of all frequencies, including radio frequencies.

GEARED TURBINE-GENERATOR UNITS—Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Leaflet No. L-20377, discusses new features of a unit that requires no bedplate because cylinder and gear housing are supported from the generator frame, has a short over-all length, and possesses rigidity, obtained by means of only four bearings. The unit requires piping and electrical connections and is then ready for operation. Units may be obtained in either the 30- or 50-kw. sizes.

Low Prices for Lead and Zinc Not Affecting Coeur d'Alene Output

District's Concentrate Production About 20,000 Tons of Lead and 5,000 Tons of Zinc Monthly—Development of Sunshine Mine the Outstanding Achievement Within the Last Few Years

A. J. Dunn
Special Wallace Correspondent

ALTHOUGH lead and zinc prices have not averaged as high during the year as expected, operations in the Coeur d'Alene district, Idaho, have not been noticeably affected. Production has generally been maintained at capacity, and new mining development has been carried on at a pace unequaled in many years. Production at this time —and it has been substantially the same throughout the year—is about 20,000 tons of lead concentrate and about 5,000 tons of zinc concentrate per month. The latter would be considerably above that figure if there was a market for zinc, but the Sullivan plant must wait until another unit is added before contracting for more zinc, and Anaconda is overstocked by existing contracts.

Broadly speaking, mining conditions in the Coeur d'Alene district are good, both from the standpoint of uninterrupted production of mines now active and the outlook for development of new mines. The labor situation is satisfactory, and few men in the district are idle. Early in the spring when the price of lead took an upward turn and advanced within a few weeks from 6.50c., New York, to 7.75c., the mining companies of the Coeur d'Alene district advanced wages of all employes 50c. per day, which made the pay of miners $5.50 per day and muckers $5, effective April 1. Although the price declined thereafter, finally reaching 6.75c., the increased wages were maintained and still prevail.

The "Big Three"—Bunker Hill & Sullivan, Federal Mining & Smelting, and Hecla—are maintaining their usual large production, and the most gratifying feature of their operations is the persistency of their orebodies at great depth. Bunker Hill has proved its orebody on what is called the No. 19 level, which is 2,100 ft. below the Kellogg tunnel, a mile from the apex of the vein and only 400 ft. above sea level. Federal Mining & Smelting, at the Morning mine, has extended the shaft and proved the orebody down to the 3,450 level, which is 4,900 ft. below the apex and 660 ft. above sea level. This is 400 ft. below the present lowest productive level, which means an oreshoot 400 ft. deep, 14 ft. wide, and 1,400 ft. long, practically untouched. Early in the year a Nordberg hoist was installed at the Morning mine with capacity sufficient for 1,000 ft. below the present deepest level. At the Hecla the oreshoot has been proved and developed down to the 2,800 level, and 400 ft. will be added to this depth upon completion of installation of the new Nordberg hoist, which will be about the middle of October.

Perhaps the most remarkable mining achievement in the Coeur d'Alene district during the year has been the development of the Sunshine mine. Three or four years ago it was still regarded, as it had been since its discovery in the early days, as a small property with little to encourage extensive development. Leasers had made good profits working the small vein of gray copper with high silver content, but geologically the prevailing opinion was against persistence of the ore at depth. However, the control of the company had been unloaded upon a group of Yakima, Wash., people without experience in mining, which probably explains why a shaft was started from the lowest tunnel level. Fortunate in having capable management, ore was proved to a vertical depth of 500 ft. and by skillful mining the small oreshoot was made to yield a profit. Two and a half years ago the company was able to pay a dividend of 2c. per share and continued paying every two months at that rate until last June, when the company adopted quarterly instead of bi-monthly disbursements and raised the dividend to 5c. per share on 1,500,000 shares outstanding, making total dividends to date $480,000. On the 500 level, an oreshoot, 16 ft. wide, that averages 145 oz. in silver per ton, has recently been exposed. The same oreshoot has just been entered, 200 ft. below on the 700 level. In the meantime the shaft has been continued to a depth of 1,300 ft., with ore proved by crosscuting on the 900 and 1,100 levels.

Sunshine has recently increased the capacity of its flotation mill from 125 tons to 200 tons daily and is now shipping six carloads of concentrate per month to the Bunker Hill smelter, each of which yields a net return of $15,000 and up. A few months ago one car returned $23,200. Three or four years ago the stock went begging at 25c.; today it is held at $6.

With the abandonment of the Hercules mine a few years ago, after a remarkable record of production and profits, the Day organization, which controlled it, ceased to be a factor of great importance from the standpoint of production. But with admirable energy and determination, the Days took up development of other properties which had been acquired by their organization, and though they have not found another Hercules, they now control three producing mines and are in line eventually to regain their position among Coeur d'Alene operators. The Tamarack, which they have long controlled, has been in continuous production, but for a long time it appeared to be approaching the end. However, a new oreshoot was discovered a few months ago in a formation more favorable than the old one, and reports are to the effect that this promises to restore the mine to large production. This optimistic outlook, however, is without official confirmation.

The Day organization also controls Sherman Lead, which is being operated through a crosscut from the Hercules. Shipments from the Sherman go to the Hercules mill at Wallace, as do shipments from all Day-controlled mines. The Dayrock mine is perhaps the best property controlled by this organization, although it remains to be proved at depth. It is developed to a depth of 300 ft. from the discovery tunnel, and on that level the oreshoot has been proved some 1,600 ft. in length. The shaft and equipment are wholly inadequate for deeper development, and reports indicate that steps are now being taken to sink a new shaft of probably four compartments and install a large hoist, probably the same that was used at the Hercules.

Wallace is the center of operations in the Coeur d'Alene district, which stands second in lead production among the mining areas of the United States

The Hercules mill at Wallace has for several months been undergoing extensive changes to modernize it and increase its capacity, making it all flotation. According to report, the mill has now a capacity of 1,000 or 1,200 tons per day. It is designed to handle ore from all Day mines and also custom ores.

Golconda Lead Mines recently announced officially that a new three-compartment shaft will be sunk to the 2,000 level, which will be 1,000 ft. below the main operating tunnel. The new shaft will be 900 ft. south of the old one and will reduce the haulage distance to that extent. A raise has just been put up from the 1,400 level to the 1,000, which will form part of the new shaft. The hoist will be underground and a large station is being cut to accommodate it and to provide room for all operating facilities. In announcing the new shaft, the management stated that the oreshoot on the 1,400 level has been drifted upon 575 ft., with ore in both faces; and that the ore, lead-zinc, averages 9 ft. wide and is larger and of better grade than

Completion of the Sullivan Mining electrolytic zinc plant, shown above, has given a great impetus to operations in Coeur d'Alene mines which carry ores high in zinc

to a depth of 1,000 ft., the purpose being to block out ore on several levels with the view to providing tonnage to supply a mill of larger capacity. At present, milling capacity is 250 tons a day. The

The Galena mill of Callahan Zinc-Lead, now operating only on ore obtained from development work

on the 1,200 level. It was also announced that a compressor of large capacity will be installed. These improvements will be followed by doubling the capacity of the mill, which is now 200 tons a day.

Last fall Constitution Mining & Milling, operating on Pine Creek, closed down for the purpose of completely modernizing its plant. This included installation of a large compressor, widening the main tunnel, cutting a large underground station, installation of a double-drum electric hoist able to operate to a depth of 1,500 ft., and raising the vertical shaft from the 200 level to the station. Carrying out this program occupied the entire winter, and early last spring the company started on its program of development, which has proved highly satisfactory. On the 400 level drifts have been extended north and south. The north drift has proved an oreshoot 900 ft. long, averaging 5 ft. wide, and the south drift has ore 400 ft. long, which in places is 10 ft. wide. The shaft is now down to the 600 level and a crosscut has just been completed to the vein. The shaft will be continued

Constitution company recently purchased a group of nineteen claims joining on the north, the presumption being that these claims cover the northern extension of the vein.

Operations of Callahan Zinc-Lead are confined to the Galena property, 2 miles west of Wallace. Extensive exploration of the Galena vein proper has not proved satisfactory to date. However, as a result of diamond drilling, a parallel vein was discovered south of the Galena. Development on the 600 level, where it was reached by the diamond drill, is proving encouraging. The vein is about 9 ft. wide and carries 11 oz. in silver per ton and 9 per cent lead. In places the grade is lower, but as the drift proceeds east the ore is apparently improving. A drift on the 800 level is now being extended, from which a crosscut will be run to this new oreshoot. At this additional depth of 200 ft. the ore is expected to prove of better grade. The Callahan company has accomplished a large amount of development at Galena, and the outlook for success is better at this time than ever before.

Interesting development plans are being carried out by Jack Waite Consolidated. The large holdings of the company lie across the Idaho-Montana divide, the larger area being in Montana, though operations are on the Idaho side. However, the vein has been crosscut on the Montana side, disclosing several feet of good ore. From that side a drift is now being extended west, while the main tunnel on the Idaho side is being extended east, the latter being 400 ft. lower than the former. About 1,000 ft. intervenes between the two faces. When they overlap a raise will be put up to connect them. Both of these drifts have been in continuous ore, and if this is maintained an oreshoot approximately 2,000 ft. long will have been proved. When this opening is completed, the Jack Waite directors have under consideration making the Montana side the seat of operations. Advantages to such a move are the more accessible location, timber available owned by the company, the railroad, 17 miles distant, reached by level road, and farming country from which to draw supplies. Plans to increase the capacity of the Jack Waite mill are held in abeyance until this connection is made.

The Bunker Hill smelter is undergoing changes in preparation for treatment of all ore from the Bunker Hill & Sullivan mine following expiration of a contract with American Smelting & Refining, under which half of the Bunker Hill & Sullivan output has been going to the plants of the latter company.

The Sullivan electrolytic zinc plant, owned equally by the Bunker Hill & Sullivan and the Hecla Mining companies, is operating at its capacity of between 50 and 60 tons of pure zinc per day. The plant was completed about a year ago at a cost of approximately $2,000,000. It was the first commercial application of the Tainton electrolytic process for the recovery of zinc, and it was found in the tryout that changes and adjustments had to be made, which resulted in much delay in bringing the plant up to maximum production. These difficulties have now been overcome, and for several months operations have been maintained at capacity, with results meeting the highest expectation.

Noranda Mill to Increase Capacity to 1,000 Tons Daily

EXPERIMENTAL work by A. W. Fahrenwald on milling practice at the Noranda Mines plant, in the Rouyn district of Quebec, is reported to have been successful, and the capacity of the mill will be increased from 500 to 1,000 tons daily. An announcement to this effect from the board of directors is expected soon. At present the plant is treating about 250 tons, but gold losses are said to be disproportionate. Treatment of copper-zinc ores, which are found on other Rouyn properties, has also afforded a problem.

In the enlarged concentrator, about 200 tons of Waite-Ackerman-Montgomery ore will be treated daily. Smelter shipments from that mine will also be increased to about 150 tons daily. By treating greater quantities of concentrate and proportionally less smelting ore, the Noranda smelter should be able to produce about 125,000,000 lb. of copper and about $3,000,000 in gold annually. Delay in putting the second smelter unit into production and completing the headframe of the No. 4 shaft has resulted from slow steel deliveries. Both units will be in operation in November. Rumors that ore is diminishing in grade in the lower levels of the mine have been denied by N. A. Timmins, director of the company.

Mohawk Adds Another Group to Ontonagon Holdings

MOHAWK MINING has acquired control, through a long-term option, of the Flint-Steel group, consisting of 760 acres, in Ontonagon County, Mich. This follows an announcement made two weeks ago that the company was taking over the Mass Consolidated property, in the same district. As a result of these two transactions, Mohawk now controls an uninterrupted stretch along the Butler lode from National Mining, on the west, to the Adventure mine, on the east. Water power and large-scale operation, resulting from the consolidation of these various properties, are expected to permit profitable copper production. Reopening of the "E" shaft of the company's Michigan mine, which will probably be the main operating unit, is now under way.

Report of Meteor Crater Strike Denied

Shaft-sinking operations at Meteor Crater, near Winslow, Ariz., have not struck a nickel-iron orebody at 1,400 ft., as reported in last week's *E.&M.J.*, according to Quincy A. Shaw, president of Meteor Crater Exploration & Mining. Shaft sinking, started in the spring of 1928, encountered a large flow of water at 650 ft., necessitating purchase of additional power and pumping equipment. After sinking 60 ft. further, conditions became so bad that work was stopped. Additional funds will have to be raised before proceeding with the work. A circular will be sent to the stockholders describing the results of the last six months of operation.

North Butte Exploring East of Fault at 2,200 Ft.

AT THE east side property of North Butte, in the Butte district, a crosscut at 2,200 ft. has been driven 700 ft. and lacks only 100 ft. to cut the Continental fault. Work will be done east of the fault to find the extension of copper ore struck on the 2,000 level. This ore was the first found east of the Continental fault in the Butte district.

In August the company shipped 7,200 tons of copper ore from the Granite Mountain mine. Production is now about 250 tons daily, according to Paul A. Gow, president and general manager of the company. An orebody has been opened 1,000 ft. north of the Granite shaft on the 2,600 level. It averages 4 ft. wide and carries 7 per cent copper.

High-Grade Ore Struck at Miller Lake O'Brien

New ore has recently been found on the Miller Lake O'Brien property, in the Gowganda silver district of Ontario, which is said to run as high as 10,000 oz. a ton over substantial widths. This property is entirely owned by M. J. O'Brien. Production is now at the rate of 1,000,000 oz. a year.

Ankerite Ceases Operations

Ankerite Gold Mines, in the Porcupine district, northern Ontario, has shut down as a result of failure to find high-grade ore. During the first five months of the year the mill treated 12,900 tons of ore, averaging $5.54 a ton, with a total recovery of $71,500.

The company started production from its 200-ton mill in the summer of June, 1926. Its property consisted of three claims, 118 acres in extent. It was financed largely by Porcupine Goldfields Development & Finance, which owned 74 per cent of the stock.

Lackawanna Shuts Down

After shipping several carloads of concentrate, the Lackawanna mill, in the Silverton district, San Juan Basin, Colo., has closed down. The plant had a capacity of 100 tons of silver-lead ore daily. It was constructed last year, and several trial runs were made during the winter. Regular operations were started last summer.

Development work at the mine in the No. 3 tunnel had shown the continuation of ore to a depth of 900 ft. However, lack of development funds caused the shutdown, according to H. C. Smith, general manager of the property. Negotiations for the sale of the property are said to be under way.

North Lily Resumes Sinking From 1,600 Level

SINKING of the North Lily shaft, near Eureka, Utah, in the East Tintic district, has been resumed at 1,600 ft. and will be continued until the Cambrian quartzite is struck. Two new orebodies have been exposed above the 1,200 level in raises 150 ft. apart. Within this area, where the faulted segment of the orebody opened on the 700 level should lie, ore reserves should ultimately be increased about 60,000 tons.

South of this area Chief Consolidated has found ore on the Eureka Bullion property, which is believed to be associated with the channel that carries the North Lily orebody. To the northeast, North Lily, which is a subsidiary of International Smelting, is prospecting another zone on the 700 level. This zone carried ore in the adjoining Tintic Bullion ground of Chief Consolidated.

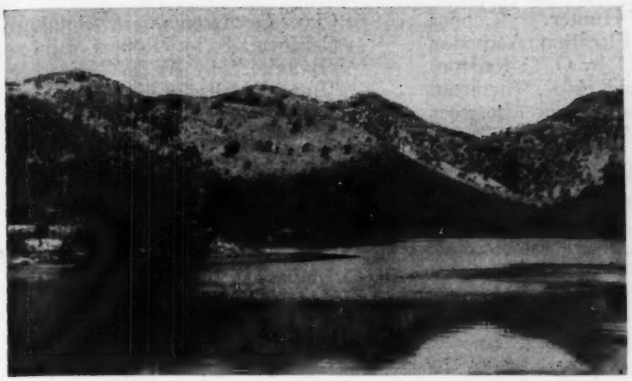
Pumping equipment with a capacity of 1,000 g.p.m. has been installed at the North Lily. The mine is making only about 300 g.p.m. from the flow struck last July. This water is being diverted into an open fissure, so that the necessity for pumping seems obviated at least for the present.

M. & M. Society Hears About Rhodesian Copper

Arthur Notman addressed the Mining and Metallurgical Society of America at the Harvard Club, New York, on Sept. 25. This was the first meeting held since the summer vacation season, the subject being the copper mines of Northern Rhodesia. Mr. Notman recently completed a trip to that part of the world and told an interesting story of what he had seen, illustrated with lantern slides and moving pictures taken by Fritz Eilers. The ensuing discussion was participated in by Messrs. Graton, Sussman, and Case.

Flotation to Be Used by All Michigan Plants in 1930

ALL THE amygdaloid mines of the Michigan copper district are treating some of their current mill tailing by flotation, which will result in saving of 2 to 4 lb. of refined copper per ton. The full benefit of flotation, however, will not become apparent until 1930, when the various mills will be fully equipped. Adaptation of the process to the respective needs of the companies has taken time, and at present the mills are only partly equipped with flotation machines. Mohawk, Copper Range, Quincy, Ahmeek, and Isle Royale have installed flotation units. Only Quincy has seriously considered reworking old tailing dumps. Its waste sands run as high as 9 lb. per ton. The company has taken steps to treat its old tailing, and a suction dredge will be installed for a thorough practical test.



At the left, the artificial lake created at the Montana property of Eagle-Picher Lead, and, at the right, the mill and mine surface plant

Complete Pipe Installation for Montana Mine, Near Ruby

INSTALLATION of a pump on the Santa Cruz River has been completed by Eagle-Picher Lead, operating the Montana mine and mill, near Ruby, Ariz. The pump will supply milling water for future needs. It is a 100-g.p.m., high-pressure horizontal duplex Worthington pump, driven by a 120-hp. Worthington Diesel engine. A pipe line, 15 miles long, connects the pump with the artificial lake that has been created near the mill to supply water for operations. The pump will operate against a total head of about 2,000 ft.

About 300 tons of lead ore is being milled daily at the Montana property, which is operated on a three-shift basis. Development work has been very encouraging, and recoveries have improved as a result of changes made in the flotation section of the mill.

United American to Look for Tom Reed Orebody

United American, adjoining the Tom Reed mine, at Oatman, Ariz., has started to deepen its shaft from 750 ft. to 1,000 ft. This is the same elevation as the 950 level of Tom Reed, where that company is now exploring a high-grade orebody. The orebody is known as the Aztec because it lies chiefly in the Aztec claim of the Tom Reed estate. The east end line of the Aztec is the west end line of the United American and on the Tom Reed 700 level the orebody extended across the end line and was mined out above that level by both companies. The same condition is expected to prevail on the 950 level. The Tom Reed drift on the 950 level is still 300 ft. from the end line.

Will Develop Bullion Mine

Development of the Bullion property, nine miles from Basin, Mont., will be undertaken by W. M. Schmidt and associates, of Milwaukee, who recently acquired it. Two tunnels, 2,900 ft. and 800 ft. long, have been driven on the property. The shorter opening, which is also lower, will be continued to strike the extension of a complex orebody struck above.

Southwestern Engineering is experimenting on the ore with a view to installing a 100-ton flotation plant.

Tybo Mill Can Handle 400 Tons, Tests Show

ALTHOUGH designed to handle only 30 0tons of ore daily, F. W. Bradley, president of Treadwell Yukon, states that the company's concentrator at Tybo, Nev., is now treating ore on a basis of 400 tons every 24 hours. The mill was speeded up last week to test its capacity when put on full time. At present only one shift is being worked, however, so that mine development may be put further ahead of the mill.

A fourth Fageol truck has been added to the fleet, in view of the heavier tonnage of concentrate that will be shipped when the mill is running full time. At present about 70 tons of concentrate is being hauled daily to Tonopah. Each truck carries a trailer and is equipped with eight balloon tires to save wear and tear on the gravel surfaced road.

Treadwell Yukon has signed a contract with the Sierra Power Company for electric power at the Bodie mines, which it recently acquired. A part of the pumping plant installed by Jake Berger and C. C. Julian when they had the mine under option will be supplemented by new pumps, as the shaft below the 500 level will be drained. Treadwell Yukon will first unwater the old Red Cloud shaft.

Basin Montana Opens New Copper Orebody

Basin Montana Tunnel has struck a new copper orebody, 5 ft. wide, on the 500 level of the Grey Eagle mine, near Basin, Mont. Shipments of ore have been made from this find and from other points on the 400 and 500 levels. A drift from the raise above the 400 level has been driven 70 ft. in high-grade lead-zinc ore.

Lake City Operators Ask Reconstruction of Spur

RECONSTRUCTION of the spur line from Sapinero to Lake City, Colo., is being asked by mine operators of Lake City, including M. B. Burke, of Empire Chief Mining. In July and August cloudbursts washed out a great part of this line of the Denver & Rio Grande Western Railroad. J. S. Pyeatt, president of the railroad, points out that reconstruction of the line would cost $40,000 and that receipts within the last ten years on that branch did not justify such an expenditure. Mr. Burke, however, states that his company, which has just completed construction of a 200-ton mill, has several years of ore reserves developed and that he feels sure the increased shipments which will result would justify rebuilding the line. Without the railroad, however, operations at Lake City might have to be discontinued because of the higher costs.

Anaconda Reopens Three Units

Anaconda Copper has reopened three of the operating units at its Butte properties. These are the Anaconda, West Colusa, and Mountain Con shafts, which were shut down for a short time undergoing repairs.

Montana Copper Formed

Montana Copper Corporation, recently formed by Montana and New York interests, has taken over a large group of claims in the Tidal Wave district, Madison County, Mont. Three oreshoots were opened by former operators, and 500,000 tons of low-grade copper-silver-gold ore is said to have been developed. Milling tests have been conducted on the ore, and the company plans construction of a 500-ton flotation plant.

W. C. Siderfin, formerly with the W. A. Clark interests, and Charles J. Stone, mining engineer, of Butte, are among the incorporators of Montana Copper. The company has 250,000 shares of no par value.

Expect Large Attendance at San Francisco Meeting

A LARGE attendance is expected at the San Francisco meeting of the A.I.M.E., which will take place on Oct. 7-10. This will be the 138th general meeting of the institute. Holding of the Spokane, Tulsa, and Los Angeles regional meetings, just prior to the general meeting, and the presence in San Francisco of large numbers of engineers who will make the trip to Japan for the World Engineering Congress, is expected to bring out an exceptionally large attendance. The program, as announced by the institute, follows:

Monday, Oct. 7.

9:00 a.m. and all day. Registration, Room D, Palace Hotel.

11:00 a.m. Concert Room. General Session. Address of welcome, by President F. W. Bradley. Response by J. V. W. Reynders, Past President. Address: "Mining Problems of the West." A speaker has been selected, but the name cannot yet be announced.

12:30 p.m. Rose Room. Luncheon.

2:00 p.m. Concert Room. General Session. Address: "The Power of the State to Control Production and Sale of Natural Resources," by W. E. Colby. Brief reviews of papers prepared for presentation at Tokyo will be presented, for the benefit of those who will not go to Japan.

7:30 p.m. Rose Room. President and Mrs. Bradley's dinner to members and guests.

Tuesday, Oct. 8.

10:00 a.m. Technical Sessions.

Section A: Mining. Concert Room. Among papers to be presented will be the following: "The Theory of Cooling," by W. S. Weeks. "Magnetic Measurements on Placer Deposits," by Eugene A. Lockton.

Section B: Milling. Sharon Room. "The Relation of Measured Surface of Crushed Quartz to Sieve Sizes," by John Gross and S. R. Zimmerley. "Differential Grinding Applied to Tailing Retreatment," by Leon M. Banks and George A. Johnson. "Development of Classification in Fine Grinding Operations," by A. Anable. "Microscopic Studies of Mill Products," by H. S. Martin. "Cyanide Regeneration or Recovery as Practiced by the Compañia Beneficiadora de Pachuca, Mexico, by C. W. Lawr. "Effect of Copper and Zinc in Cyanidation With Sulphide-acid Precipitation," by E. S. Leaver and J. A. Woolf. "Reducing and Oxidizing Agents and Lime Consumption in Flotation Pulp," by the research staff of the United Verde Copper Company. "Activation of Sphalerite for Flotation," by O. C. Ralston and William C. Hunter. "Copper Sulphate as Flotation Activator for Sphalerite," by O. C. Ralston, C. R. King and F. X. Tartaron. "Milling Practice at Benguet Consolidated," by J. L. Colbath.

12:30 p.m. Rose Room. Luncheon.

2:00 p.m. Technical Sessions.

Section A: Concert Room. Brief reviews of Bureau of Mines publications on mining methods: At Ray Mines of Nevada Consolidated, by W. S. Boyd; At Inspiration, by A. C. Stoddard; At Magma, by F. W. Snow; and at Engels Copper, by W. I. Nelson. "Status of the American Quicksilver Industry," by G. C. Maier and others. "Recent Progress in the Metallurgy of Quicksilver," by L. H. Duschak.

Section B: Rooms A and B. A series of papers on the non-metallic minerals, a subject of ever-increasing importance to the Pacific Coast, is planned for this session. "Geological Features of Clay Occurrences in Southern California," by Robert Linton. "Bauxite," by W. W. Bradley. "Impact Mills for Grinding Fireclay," by O. M. Tupper, Jr.

7:30 p.m. Tapestry Room. Directors' Dinner. Followed by Board of Directors' meeting.

Wednesday, Oct. 9.

10:00 a.m. All day excursion on San Francisco Bay, returning by 5 p.m. Evening. Dinner and dance at the St. Francis Yacht Club.

Thursday, Oct. 10.

Morning. Available for group visits to plants of interest in the vicinity, to be arranged with the excursion committee and in accord with the wishes of each guest.

4:00 p.m. Embarkation of delegates and guests for the World Engineering Congress in Tokyo aboard the "President Jackson," of the Dollar Line, and the "Korea Maru," of the Nippon Yusan Kaisha.

Milling plant at Chain O'Mines

Chain O'Mines Has Ambitious Program in View

PLANS now contemplated by Chain O'Mines, operating properties in Gilpin and Clear Creek counties, Colo., have in sight the handling of 1,600 tons of silver-gold ore, according to W. M. Muchow, president of the company. About 200 tons is being treated by flotation at present, with additions under way that will raise capacity to 500 tons. A cyanide unit is also being built. Mining development on the Patch properties of the company has demonstrated a large tonnage of ore available, according to Kirby Thomas, consulting engineer.

The orebodies occur in a mass of altered rock and vein material, about 1,000 ft. long and 500 ft. wide. This formation extends from the surface to the Argo tunnel level, a vertical distance of 1,600 ft. Practically identical geological conditions have been found on the three levels where exploration work has been done, Mr. Thomas declares. Work has been conducted through the LaCrosse tunnel, 300 ft. deep; the Quartz Hill tunnel, 700 ft. deep; and the Argo tunnel, 1,600 ft. deep.

Strike Junore on 2,150 Level of Goldfield Deep

Goldfield Deep Mines, at Goldfield, Nev., reports that seams carrying gold, silver and copper, with some nodules of lead, have been struck in the drift from the long crosscut on the 2,150 level of the property. Although only junore, that is, material too low grade to treat at a profit, has been found, conditions are considered favorable for developing a new orebody. Similar formations prevailed on upper levels where rich ore was discovered.

The exploratory program of Goldfield Deep is the only important exploration work now going on in the famous boom town of 1906-1907.

Mount Isa Mines Now Employing About 1,000 Men

ABOUT 1,000 men are now employed at the Mount Isa silver-lead-zinc property, in Queensland, Australia, according to the most recent dispatches. Sickness, mostly influenza, has been prevalent, and work has been hindered slightly. Mount Isa is also having some trouble with its water supply. The rainy season, which was a good one throughout most of western Queensland, was poor at Mount Isa, and the dam at the mouth of Rifle Creek, 20 miles from the mine, was only one-third filled.

Water supply for domestic purposes has been obtained from several artesian wells near the river. The company is now sinking fifteen new ones. While at Mount Isa in August, Leslie Urquhart, chairman of the company, examined localities in the neighborhood from which water might possibly be obtained in the future.

Reports from company headquarters in London show favorable drilling results in three new holes. Holes B-5, 400 ft. south of the Davidson shaft, struck ore at 1,047 ft. It assayed 5 per cent lead, 5.9 per cent zinc, and 3 oz. of silver per ton over a width of 179 ft. Hole B-12, 1,200 ft. north of the Davidson shaft, struck two oreshoots, the first at a depth of 1,157 ft. It was 54 ft. wide and assayed 5.7 per cent lead, 6.7 per cent zinc and 1.8 oz. of silver. The second oreshoot was 30 ft. wide, assayed 8 per cent in both lead and zinc, and 3.8 oz. of silver. The latest hole to strike ore is A-9. Drilling 800 ft. south of the Davidson shaft, ore was struck at a depth of 791 ft. The main orebody averaged 5.5 per cent lead, 7.1 per cent zinc, and 1.6 oz. of silver over a width of 147 ft.

Guinea Austral Options Ground in Edie Creek Area

Option on ground in the Edie Creek gold field of New Guinea, adjoining the Ellyou property of Mining Trust, of London, has been taken by Guinea Austral. R. A. Clinton, engineer for the company, reports that the area is a mile and a half west of Wau and embraces about a mile along Koranga Creek. The total area of the option is about 150 acres. Mr. Clinton estimates known reserves of 436,906 cu.yd., averaging about 5s. 9d. a yard. The purchase price is £21,000 in cash and 10,000 shares in the company. The option is for only three months.

Report New Alaskan Find

A. H. Bradford, general superintendent for Pacific-American Fisheries, reports the discovery of a vein of silver-lead-zinc-copper ore on Popoff Island, of the Shumagin group, western Alaska. The vein has been traced for 600 ft. and is reported to average $16 in all metals per ton.

Report Large Reserves at Bulolo River Property

AN OFFICIAL STATEMENT of reserves is contained in a memorandum to the shareholders of Placer Development, which owns 4½ miles along the Bulolo River, in New Guinea. C. A. Banks, managing director, places the total shown by drilling at 39,000,000 cu.yd. of gravel, averaging 50c. in gold per yard. Two dredges, with a combined capacity of 3,000,000 cu.yd., will be installed. Ample water power for electricity is available, and total costs are placed at 16c. per yard treated.

Chrome Refinery Dispute Ended on Sept. 20

SETTLEMENT of the dispute between the company and the workers at the U. S. Metals Refining plant at Chrome, N. J., was effected on Sept. 20 and operations at the copper refinery, which is controlled by American Metal, were resumed on that day. Closing of the plant on Sept. 9 was decided upon by the company to prevent a strike from disrupting operations when the furnaces were not banked. The suspension affected about 2,000 employees.

Dispute arose over the method of payment of the workers. According to the bonus system in force, men received 45c. an hour for working full time and only 40c. an hour at other times. They demanded a flat rate of 50c. an hour, regardless of the number of days worked, and a weekly payday instead of the biweekly method used. According to the settlement which was accepted by the workers, the company has agreed to eliminate the bonus system and to establish a weekly payday. However, the rise in wages from 45c. to 50c. has not been granted.

Will Install New Pumps to Unwater Leadville Mines

UNWATERING of the downtown area of the Leadville district, which is being undertaken by Penrose Mines, has been started. Two pumps, each handling 2,000 g.p.m., are now in operation, and four more pumps have been ordered. When unwatering was started, the water level was only 240 ft. from the shaft collar. In addition to unwatering the Penrose workings, the pumping will benefit several other mines in the district, including East Seventh Street Mining, Evening Star, Waterloo and Coronado.

Production from the property is about 100 tons daily. A special rate for power has been made by the Public Service Company of Colorado, so that the cost of pumping will not be excessive.

Howe Sound Options Mines in Kitsault District

HOWE SOUND, through its subsidiary, Britannia Mining & Smelting, has taken a lease and option on the Dolly Varden and Wolf mines, in the upper Kitsault River district of British Columbia. The properties are owned by Victor Spencer and associates of Vancouver. Terms of the bond have not been made public.

The Dolly Varden property was developed by George Wingfield and associates, who gave a contract to the Taylor Engineering Company, of Vancouver, for a railroad from Alice Arm up the Kitsault River. The Taylor company appears to have exceeded instructions, and Mr. Wingfield refused to pay. Litigation followed and, during its course, the provincial legislature passed a special act awarding the mine and railroad to the Taylor company in consideration for the construction work.

During the high prices for silver in 1920-21, Taylor Mining, a subsidiary formed to work the mine, and now defunct, produced about 1,300,000 oz. of silver.

Equip Algerian Quicksilver Mine for Production

A modern quicksilver plant is being installed at the Ras-el Ma property in the department of Constantine, Algeria, according to a report to the U. S. Department of Commerce. The new plant, which will be completed this autumn, will have a capacity of 120 tons of ore daily. Production in 1930 is expected to be about 100 tons of the metal, or about 3,000 flasks. This production will gradually be increased to 200 tons in 1932.

Ventures Options Aurum

Ventures, Ltd., has taken a short-time option on 400,000 shares of Aurum Mines at $1.25 per share. This company has been exploring a large consolidation of claims, including the Emancipation group, in the Yale district of British Columbia. Some gold ore occurring in small veinlets and kidney-shaped secretions of arsenopyrite in a zone of crushed and contorted slate and greenstone has been found on the surface and at shallow depths. Two deeper tunnels have failed as yet to find the deposit.

Keeley to Continue Exploring

At the annual meeting of stockholders of Keeley Silver, operating properties at South Lorrain, Ont., official statement was made that developments on the lower contact were sufficiently favorable to encourage continuation of exploration work. Mill-grade ore is being obtained from this level, and a high-grade oreshoot has also been discovered. It is 40 ft. long and carries two veins, 6 in. wide, averaging 3,000 oz. of silver per ton.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Anxiety Aroused by Failure to Hear From Two Planes on Prospecting Trip

TORONTO, Sept. 21, 1929.—Fears are expressed for the safety of two Dominion Explorers airplanes which are overdue at Fort Norman, in northern Alberta. The personnel of the party consists of Colonel C. D. H. MacAlpine, president of Dominion Explorers; Richard Pearce, editor of *The Northern Miner*; Captain S. E. McMillan, and Colonel C. A. Thompson, pilots, and Alex. Milne, mechanic. The trip was expected to cover 10,000 miles, and the party left Baker Lake, at the head of Chesterfield Inlet, in the Barren Lands, on Sept. 8, for Bathurst Inlet, on the Arctic Ocean.

Apprehension arises from the fact that ice has formed on some of the inland lakes and the pontoon-equipped planes, in which the party was traveling, might encounter hazardous flying conditions. Plans are already being made for an extensive search. The base will probably be at Lac la Ronge, northern Saskatchewan, one of the Dominion Explorers bases. Two planes have already left Fort McMurray and will proceed to Fort Simpson, where they will await instructions by wireless.

THOSE most familiar with northern conditions do not believe that the failure to obtain news points to disaster. The party may have been delayed through unfavorable weather conditions, but in any event would probably reach one of the northern bases, and at the worst have to wait until after the freeze-up.

Central Manitoba has decided on a program of diamond drilling to explore the property at depths of 750 and 1,000 ft. During August 4,565 tons was milled. The recovery was $36,903 from ore averaging $8.35.

At the annual meeting of Pioneer Mining, an estimate was made of the ore reserves of the company's Michipicoten properties in northwestern Ontario. On the Minto claim 60,000 tons of $10 ore has been developed and on the Jubilee 60,000 tons of $7 ore. The question of a mill has not yet been decided. Two of the English directors are expected here within the next few days and some decision may then be arrived at.

During August Dome Mines, of Porcupine, milled 46,400 tons and recovered $317,727, an average recovery of $6.85 a ton. This compares with an $8 recovery during the earlier months of this summer.

Considerable interest attaches to the statement by Premier Ferguson of Ontario that the recently completed diamond-drilling campaign at Blacksmith Rapids, in northern Ontario, shows a large tonnage of lignite of good grade. The presence of lignite of an inferior grade has been known for some years and the Department of Mines finally decided to test the ground thoroughly by drilling. The original discoveries did not indicate any tonnage of importance, but the beds found at greater depth, as a result of the work undertaken by the government, indicate that these deposits have definite possibilities. This is the only coal known in Ontario.

Mexico City Letter

BY W. L. VAIL
Special Correspondent

Decrease in Mine Tax Field Reflects Declining Output of Mexican Producers

MEXICO CITY, Sept. 20, 1929.—Taxes on Mexican metal production in August yielded 861,744 pesos, according to statements given out by the special tax department of the federal treasury. This is 267,312 pesos less than in July. No particular reason is given for the decrease, although exhaustion of ore reserves in certain districts is probably one of the most important. Production of Cinco Minas, Amparo, and other producers in Jalisco has been greatly reduced recently, and the power shortage in Chihuahua may also have had some effect. Some mines are rumored to be increasing production so as to mine as much as possible before the passage of the proposed labor law increases operating costs. However, that any such steps are being taken by the large producers seems doubtful. In connection with the labor law, a great parade of labor unions was staged recently in Mexico City, urging the passage of the law practically as projected.

CONSTRUCTION of a small stamp mill has been completed at the Puerto Corral property, State of Guerrero, and shipments of concentrate are being made regularly to the American Smelting & Refining plant at Monterey. The company, which owns 104 claims, is reorganizing its capital structure with a view to increasing the scale of operations. An option on the Vesper and Anexas property, near Acapulco, in the same state, has been taken by new interests. A mill will be erected to treat material from the mine dump and from the stopes. When the property was formerly operated this material was junore, but flotation has rendered profitable treatment possible.

Construction of a 40-ton quicksilver furnace at San Miguel, State of Chihuahua, is now being undertaken by National Quicksilver. About 100 men are employed under the direction of Paul Ginther. Two artesian wells and a storage dam to insure water supply are also being provided. These deposits are about 125 km. from Santa Rosalia.

Johannesburg Letter

BY OWEN LETCHER
Special Correspondent

Geologists Attending Congress Favorably Impressed by South Africa's Mines

JOHANNESBURG, Aug. 15, 1929.—With the conclusion of the sessions of the British Association and of the International Geological Congress in South Africa, scientists and geologists from many parts of the world are now returning to Europe and America and to various other countries. One and all are imbued with a very definite feeling of optimism in regard to this young country, particularly in regard to its future as a mineral-producing region. From a mining point of view, the two areas which attracted principal attention are the Witwatersrand gold field and the great base-metal belt of Northern Rhodesia. Various other fields have of course engaged much attention, but that the Rand, which has for so long been recognized to be the world's leading gold field, and the country lying immediately south of the Katanga frontier (which in the opinion of many competent judges is likely to become the greatest copper-producing country on earth) should engage the greater part of the attention of visitors is not surprising.

AS FAR as the Rand is concerned, scientific interest has chiefly been focussed on matters concerning health and hygiene. Dr. Haldane's paper on suggested methods of reducing the occurrence of miners' phthisis and tuberculosis has induced members of medical staffs, managers, and engineers to review all the known facts in regard to diseases of the respiratory organs contracted by mine employees, and although the general tendency is to doubt the practicability of Dr. Haldane's theories, his suggestions will certainly not be turned down hastily.

Northern Rhodesia continues to absorb an enormous amount of attention. The copper belt of the Congo-Zambezi watershed is in fact for the moment the center of attraction of the mining section of Throgmorton and Wall Streets, and the eyes of operators are focussed on those amazing deposits which extend along the Congo frontier from Bwana to N'Changa and indeed far beyond that to Kansanshi. This mine continues to open up in a very satisfactory manner. A railroad from Kansanshi to intersect the Benguela railroad in Angola has been surveyed. This will bring the Northern Rhodesian copper fields within 1,200 miles of Lobito Bay.

A new Northern Rhodesian hydroelectric company is being formed to acquire and develop power resources on the Lunsenfwa River, and will be brought out under the aegis of the numerous groups, with Rhodesian Anglo-American as chief sponsors.

MARKET AND FINANCIAL NEWS

Dividend Payments for September Show Healthy Increase

FURTHER improvement in the financial standing of mining companies is indicated in the returns to stockholders during September. Total dividend disbursements for the month amounted to $46,327,048, a record figure for the September period. Compared with September of last year the payments to stockholders show a gain of 34 per cent.

Dividend disbursements for the first three-quarters of the year—March-June-September—amounted to $132,676,292, which compares with a total of $100,608,903 for the corresponding period in 1928. This comparison holds for those companies making dividend payments on the dates covered in this summary, the total for the year to date, by months, being much in excess of the sums specified. Returns to stockholders in September, contrasted with the sums paid out in June and March, for 1928 and 1929, follow:

Comparison of Dividends, 1928-1929

	1928	1929
March	$32,299,402	$38,852,438
June	33,828,275	47,496,806
September	34,481,226	46,327,048
Totals	$100,608,903	$132,676,292

With metal prices holding a comparatively steady price course, and as the business outlook for the remainder of the year is generally favorable, that dividend payments for the year will show a substantial gain over those of the preceding year is a foregone conclusion.

Copper shares have profited most by the more favorable price situation in non-ferrous metals. A year ago copper sold at 15c. delivered in Connecticut, against the prevailing quotation of 18c. Actual consumption of copper in the United States has held up remarkably well at the higher prices.

Mining shares, taken as a whole, have moved upward, following the general trend in security values. This has resulted in lowering the annual yield for quite a number of issues. Compared with other security values, the mining companies have made an excellent showing from the standpoint of returns on money invested.

In September, Utah Copper Company dividend payments amounted to $6,497,960, against $3,248,979 in the corresponding month last year. Nevada Consolidated distributed $3,642,936, which compares with $1,820,666 in September, 1928. Dividend disbursements in September by both Calumet & Arizona and Calumet & Hecla were up about 100 per cent from the sums sent to stockholders during the same month last year.

E. & M. J. Compilation of Mining Dividends and Yields for September, 1929

Companies in United States	Situation	Per Share	Total Disbursements	Annual Per Cent Yield
American Metal	U. S. and Mex.	$0.75 Q	$630,984	4.0j
American Metal, 6% pfd.	U. S. and Mex.	1.50 Q	103,014	4.7j
American Smelting & Refining, pfd.	U. S. and Mex.	1.75 Q	875,000	5.2j
Bunker Hill & Sullivan, s, l	Idaho	0.75 MX	245,250	6.2j
Calumet & Arizona Mining, c	Arizona	2.50 Q	2,042,165	6.3j
Calumet & Hecla Consolidated, c	Michigan	1.00 Q	2,001,141	8.9j
Cleveland-Cliffs Iron	Michigan	1.00 Q	400,000	4.1j
Federal Mining & Smelting, pfd., s, l, z	Idaho, Okla.	1.75 Q	126,000	7.0j
Golden Cycle Mining & Red., g	Colorado	0.04 Q	60,000	9.0j
Hecla Mining, l, s	Idaho	0.25 Q	250,000	4.1j
Homestake Mining, g	S. D.	0.50 M	125,800	8.5j
Inland Steel	Minn.	0.875 Q	1,034,650	3.9j
Isle Royale, c	Michigan	0.50 SA	75,000	4.3j
Mohawk Mining, c	Michigan	2.00 Q	230,000	13.3j
National Lead	U. S.	1.25 Q	387,289	2.7j
National Lead, pfd. "A"	U. S.	1.75 Q	426,433	5.0j
Nevada Consolidated Copper	Nev., Ariz., N. M.	0.75 Q	3,642,936	5.8j
St. Joseph Lead, l, z	Missouri	0.75 QX	1,463,637	4.4j
Sunshine Mining, c, s, l, z	Idaho	0.05 Q	75,000	3.3
Tenn. Copper & Chemical	Tenn.	0.25 Q	210,767	5.4j
Texas Gulf Sulphur, su	Texas	1.00 Q	2,540,000	5.5j
Tintic Standard, s, l, z	Utah	0.30 QX	345,994	9.8j
U. S. Steel	U. S.	1.75 Q	14,232,470	3.0j
Utah Copper	Utah	4.00 Q	6,497,960	4.6j
Companies in Other Countries				
Chile Copper	Chile	0.875 Q	3,863,361	3.5
Hollinger Consolidated Gold	Ontario	0.05 M	246,000	10.4j
International Nickel, n, c	Ontario	0.25 Q	2,947,161	1.7
Lucky Tiger-Combination, g, s	Sonora	0.025 M	35,789	10.4
McIntyre-Porcupine, g	Ontario	0.25 Q	199,500	7.1j
Patiño Mines and Enterprises, t	Bolivia	0.97	1,013,747	....
Total			$46,327,048	

s, silver; l, lead; z, zinc; c, copper; g, gold; n, nickel; t, tin; h, holding; Q, quarterly; QX, 50c. regular quarterly and 25c. extra; M, monthly; SA, semi-annually; j, based on dividends for the last twelve months.

United Verde Ex. to Request Lower Mine Valuation

UNITED VERDE Extension Mining company has served notice on the Arizona State Tax Commission that it will appeal to Yavapai County Superior court, Prescott, in an effort to obtain a lower valuation on its mine and personal property than the amount of $17,500,000 fixed by the equalization board.

The mine of the United Verde Extension company at Jerome, Ariz., was valued at $14,812,000 by the state tax commission, and personal property went on the rolls at $2,637,560. The company will seek to have the valuation reduced to approximately $8,000,000. In its annual report the company stated that the life of the mine is not expected to be more than three years.

Lake Shore Mines Output Shows Gain for Year

THE NET profit of Lake Shore Mines, Ltd., for the year ended June 30, 1929, was $2,504,000, compared with $1,681,000 in the preceding year. During the year total production amounted to $5,504,858 from 367,000 tons, or an average recovery of $15 per ton, against $15.25 in 1928. Production, on account of the largest tonnage treated, showed an increase of $1,900,000.

Costs were $7.15 a ton, net earnings per share $1.27, and dividend paid $1 a share.

Production and profits are running ahead of earlier in the year, output for the final quarter being $1,819,000, compared with $930,000 in the first quarter of the company's fiscal year. Operating costs were $6.34 a ton, divided as follows: Development, $2.34; mining, $2.58; milling and refining, $1.22; general and administrative expenses, 20c. Depreciation, amounting to 81c. a ton, brought the total costs to $7.15.

SOUTH KALGURLI CONSOLIDATED, LTD., Western Australia, reported net profit for the year ended March 31 of £31,765, against £31,589 in the preceding year. The company treated 102,548 tons of ore, of a gross value of £191,548, against 97,897 tons, valued at £189,491, in the previous year. Ore reserves are placed at 236,000 tons blocked out. An arrangement has been made with the North Kalgurli company, whereby portions of the Kalgurli lease and the Croesus Proprietary lease are to be worked by the South Kalgurli company on a profit-sharing basis.

Copper Production Again Declined in August

THOUGH stocks of blister and refined copper in North and South America increased by about 9,000 tons during August, the production declined further, and with the recent improvment in shipments, stocks are expected to recede a little at the end of September. Statistics released by the American Bureau of Metal Statistics follow, in tons:

Refined Copper Production, Shipments, and Stocks—North and South America

	August 1929	Jan.–Aug. 1929
Production:		
Primary	138,822	1,169,135
Scrap	9,826	71,960
Total	148,648	1,241,095
Daily rate	4,795	5,107
Shipments:		
Exports	45,035	413,681
Domestic	96,970	788,508
Total	142,005	1,202,189
Stock, Aug. 31	104,372	.....

Summary of Copper Statistics in July and August

	July 1929	August 1929
Production:		
U. S. mines	79,229	78,885
Blister, No. America	107,807	104,523
Blister, So. America	31,222	30,971
Refined, No. and So. A.	153,513	148,648
World, blister basis	174,347	.....
Stocks:		
No. and So. America		
Blister and in process	239,470	241,678
Refined	97,729	104,372
Total	337,199	346,050
Great Britain, total	10,405	10,862
Havre	7,962	7,536

Distribution of United States Copper Production

	July	August
Porphyry mines	31,819	31,118
Lake mines	7,915	7,120
Vein mines	34,095	35,147
Custom ores	5,400	5,500
Total crude production	79,229	78,885
Daily rate	2,556	2,545
Imports in ore and matte	7,968	.....
Blister from scrap	4,305	.....
Smelter production	94,690	.....

North Lily Mining Company Acquires Knight Holdings

CONTROL of the Knight Investment Company holdings in the Tintic district, Utah, has passed to the North Lily Mining Company of the International Smelting Company, through the ratification by North Lily stockholders of a contract whereby 100,000 shares of North Lily stock is exchanged for 9,000 acres, including the Big Hill, the Twentieth Century, the Empire Mines, Defender Mining & Milling Company, Eureka Hill Railway Company, Eureka Swansea Extension, Middle Swansea, Swansea Consolidated, Tintic Drain Tunnel, and a substantial minority interest in North Godiva and the Tintic Central companies.

The 100,000-share block of North Lily stock is to be placed in the treasury of a newly formed holding company, the North Lily Knight Company. North Lily guarantees $100,000 annually for three years for development of North Lily Knight holdings. This money is to be derived either from dividends or from reserves of the North Lily.

Freeport Texas Earnings Higher Than Last Year

FREEPORT TEXAS COMPANY reports for the quarter ended Aug. 31, 1929, net profit of $869,357 after expenses and reserves for depreciation and taxes, against $1,136,482 in the preceding quarter, and $680,962 in the third quarter of the previous fiscal year.

Consolidated income account for the quarter ended Aug. 31, 1929, compares as follows:

	1929	1928
Gross sales	$3,313,719	$2,783,628
Costs and expenses	2,211,355	1,989,165
Gross profit	$1,102,364	$794,463
Other income	34,986	28,245
Total income	$1,137,350	$822,708
Depreciation and taxes	267,993	141,746
Net profit	$869,357	$680,962

Net income for the nine months ended Aug. 31 totaled $2,742,876 after deducting usual charges, equal to $3.76 a share, against $1,952,393, or $2.67 a share, in the same period of the preceding year.

Vieille-Montagne Floating 150,000,000 Fr. Bond Issue

Vieille-Montagne, the Belgian zinc producer, is floating a bond issue of 150,000,000 fr. in France and Belgium. Each bond will have a par value of 1,000 fr. The issue in France will consist of 50,000 bonds paying 5 per cent. They will fall due in 1962. The company reserves the right to redeem them at par at any time after 1934, either in part or in whole. The Belgian issue will consist of 100,000 bonds paying 6 per cent. Stockholders in the company will be given the right to subscribe for these bonds at 985 fr., in the ratio of one bond for each four shares of the company's stock held. This issue may be redeemed at par any time after 1939 and before 1954, when the bonds fall due.

Federal Mining Quarter Above 1928 Period

FEDERAL Mining & Smelting reports for the quarter ended July 31, 1929, net earnings of $765,443 before depreciation, depletion, and taxes, comparing with $691,135 in the quarter ended July 31, 1928. Earnings for the quarter are before deducting $30,370 for construction and equipment, against $49,791 in the July 31 quarter of the previous year.

In the three months ended July 31 the company shipped 41,664 tons of concentrates to smelters compared with 39,190 tons in three months ended April 30 and 35,332 tons in three months ended July 31, 1928.

Dividend Increased by Granby Consolidated

THE directors of the Granby Consolidated Mining, Smelting & Power Company, Ltd., have declared a quarterly cash distribution of $2 a share on the capital stock, placing the issue on an annual $8 basis. This is double the rate that was paid at this time last year. The dividend will be paid on Nov. 1 to stock of record on Oct. 18.

In announcing the increased dividend Nathan L. Amster, chairman of the executive committee, said the corporation's cash was between $4,000,000 and $5,000,000 and that working capital was in excess of $6,000,000. The company was earning at the annual rate of $9 to $10 a share, with income applicable to dividends for the first eight months of this year estimated at about $6.30 a share. Production of copper was now at the annual rate of about 61,000,000 lb.

Increase in Lead Stocks Arrested in August

TOTAL stocks of lead in the United States and Mexico amounted to 173,468 tons on Aug. 1, according to the American Bureau of Metal Statistics, a decrease of 144 tons from a month before. In the two preceding months considerable increases had been reported. Refined pig lead stocks on Aug. 1 were 66,989 tons, compared with 58,910 tons a month before, and antimonial pig lead stocks were 5,884 tons, compared with 7,349 tons on July 1.

The lead content of ore received by United States and Mexican smelters in July was 81,531 tons, compared with 78,216 tons in June. There was little significant change in the detailed receipts except that the lead content of Mexican ores received by United States smelters increased from 890 tons in June to 2,141 tons in July, this tonnage being the largest reported for two years.

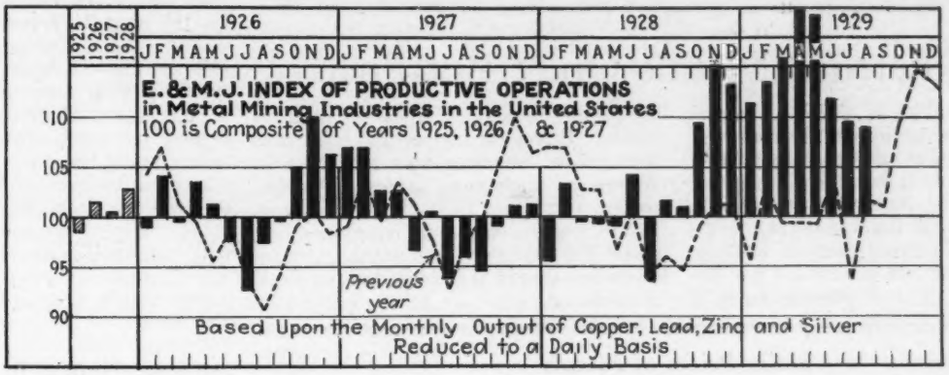
Record Dividends Paid by Utah Companies

A TOTAL of $24,375,718 has been disbursed by Utah non-ferrous metal mines during the first nine months of the year up to and including Sept. 20. This record-breaking sum exceeds all totals for any entire year in the history of the Utah industry with the exception of 1917, when $29,471,015 was paid. By the end of 1929, this record will be surpassed, as Utah mines will have paid $32,000,000 if disbursements continue at the present rate.

Of the list of nine dividend payers, Utah Copper ranks first, with $19,493,880 disbursed. Tintic Standard is second, with $1,278,665, followed by Park Utah, with $1,256,100. Others are: Silver King Coalition, $1,220,464; North Lily, $596,661; New Quincy, $286,672; Utah-Apex, $132,050; Bingham Mines, $93,700; and Yankee Mines, $17,526.

Indicators of Industrial Activity

of Significance to Mining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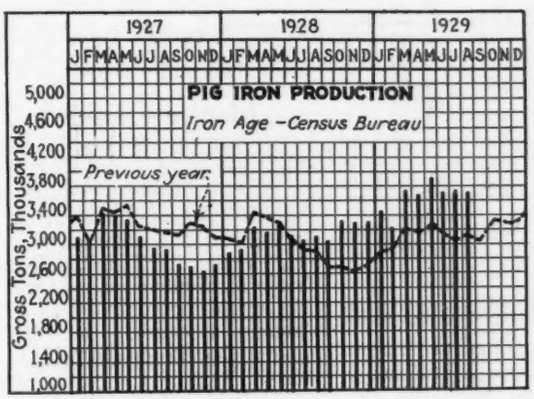
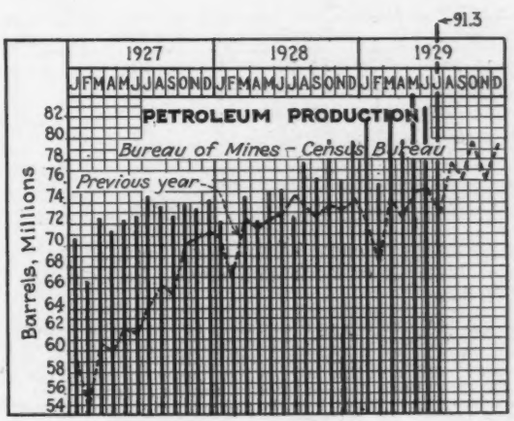
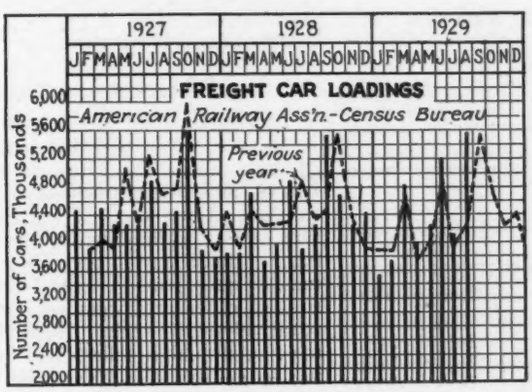
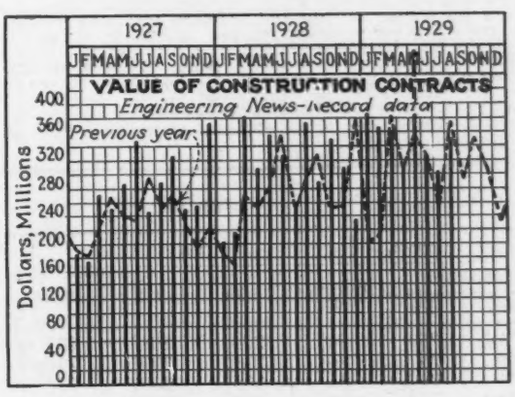
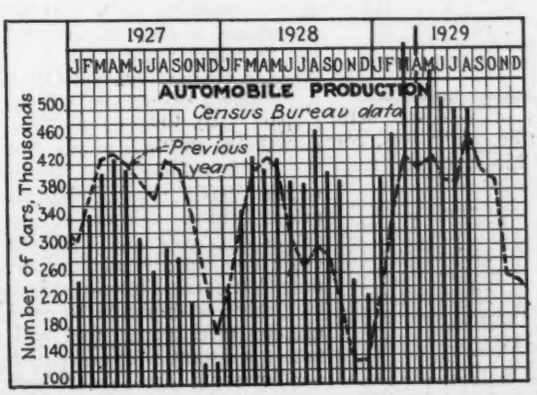
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
E. & M. J. INDEX OF PRODUCTIVE OPERATIONS
in Metal Mining Industries in the United States
100 is Composite of Years 1925, 1926 & 1927
110
105
100
95
90
Previous year
Based Upon the Monthly Output of Copper, Lead, Zinc and Silver
Reduced to a Daily Basis

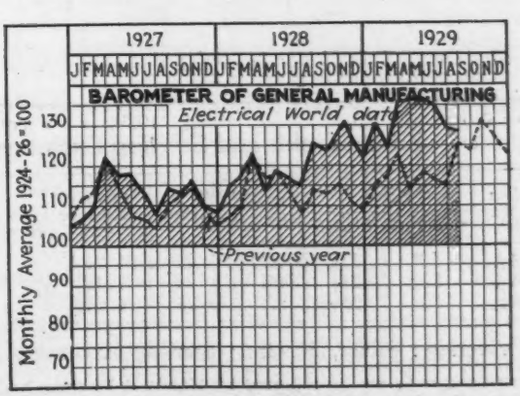








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1928
1929
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
BAROMETER OF GENERAL MANUFACTURING
Electrical World data
Previous year
Monthly Average 1924-26 = 100
130
120
110
100
90
80
70

The Market Report

Non-Ferrous Metals Quiet But Firm

New York, Sept. 25, 1929.—Domestic consumption of major non-ferrous metals is holding at a satisfactory level, but buying continues along most conservative lines. Sales for the week of both copper and lead were below the average, and judging from the business that was placed fabricators are not disposed to abandon their present policy of purchasing only against near-by requirements. Prices for copper and lead were firm. Zinc business was moderate in volume at unchanged prices. Demand for tin was quiet throughout the week. In the minor items some irregularity in prices for antimony was noted. Quicksilver was steady at $124@$125 per flask of 76-lb.

Daily Prices of Metals

Sept.	Electrolytic Copper	Straits Tin	Lead		Zinc
	Refinery	New York	New York	St. Louis	St. Louis
19	17.775	45.25	6.90	6.70	6.80
20	17.775	45.50	6.90	6.70	6.80
21	17.775	45.50	6.90	6.70	6.80
23	17.775	45.375	6.90	6.70	6.80
24	17.775	45.25	6.90	6.70	6.80
25	17.775	45.00	6.90	6.70	6.80
	17.775	45.313	6.900	6.700	6.800

Average prices for calendar week ending Sept. 21, 1929, are: Copper, 17.775c.; Straits tin, 45.354c.; New York lead, 6.900c.; St. Louis lead, 6.700c.; zinc, 6.800c.; and silver, 50.563c.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; that is, delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted.

Quotations for copper are for the ordinary forms of wirebars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight differential. Contract prices for High-Grade zinc delivered in the East are 1@1¼c., depending upon purity, above St. Louis prices for Prime Western.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Sept.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
19	74 9/16	75⅛	84¼	204⅜	208⅜	23⅝	23½	24⅜	24¾
20	74½	75	84½	205½	209⅛	23 9/16	23½	24⅜	24 11/16
23	74	74 9/16	84¼	205⅜	209½	23⅝	23 9/16	24 7/16	24⅜
24	74 5/16	74½	84½	205⅜	209½	23 11/16	23⅝	24	24¼
25	74	74½	84¼	204⅜	208½	23⅝	23 9/16	23 7/8	24⅛

Prices for lead and zinc are the official closing prices for the morning session of the London Metal Exchange; prices for copper and tin are the official closing buyers' prices. All are in pounds sterling per long ton (2,240 lb.).

Silver, Gold, and Sterling Exchange

Sept.	Sterling Exchange "Checks"	Silver		Gold London	Sept.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
19	$4.84 1/16	50½	23½	84s11½d	23	$4.84 1/16	50½	23 7/16	84s11½d
20	4.84 7/16	50⅝	23½	84s11½d	24	4.84¼	50⅝	23½	84s11½d
21	4.84⅛	50½	23 7/16	.....	25	4.84⅜	51	23 11/16	84s11½d

Average: Silver, 50.625c.; Sterling Exchange, $4.84156.

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of silver, 999 fine. London silver quotations are in pence per troy ounce of bar silver, basis 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

Copper Holds Firm

Despite rather slow trading, the market for copper presents a firm undertone. Business placed during the week was well below the average in volume, though slightly better than in the preceding week. Demand was chiefly for prompt and October shipment. Consumers appear to be fairly well covered so far as the October position is concerned, but much November copper remains to be bought. All business was placed on the basis of 18c. for Connecticut deliveries and 18⅛c. for the Middle West. Export demand also was quiet, with the price unchanged at 18.30c. c.i.f. European ports. Export business for the month to date is placed at 55,000 long tons.

Reports from fabricators are encouraging, business in wire, cable, and brass being described as excellent for this time of the year. Producers of copper believe that production and consumption of copper closely balance one another, with the result that the market is fundamentally sound.

Moderate Trade in Zinc

Demand for zinc was quiet, but prices remained steady on the basis of 6.80c. St. Louis. Inquiry, though moderate, did show some improvement, and producers feel that some good buying will soon make itself felt. Demand was chiefly for September and October metal. The world's output of slab zinc during August amounted to 136,406 tons, against 136,018 tons in July, and 129,347 tons in August last year, according to the A.B.M.S. The daily rate of production for the first eight months of the current year was 4,421 tons, against 4,308 tons for all of last year.

Lead Market Unchanged

The lead market has been featureless in the last week, with the total volume of sales about the same as the week before, and prices unchanged at 6.90c. in New York and 6.70c., St. Louis. One seller did the best business that he has in three weeks, and found acceptance of quotations general, but the business of other producers was on a comparatively small scale. More lead could have been sold if sellers had been willing to go into the November and December positions, but producers consider conditions such that a gradually advancing market may result, and they are therefore more than ever averse to booking business beyond October. Sales were above normal in August, so that a quiet September might have been expected, but the indications now are that the total volume this month will be within 10,000 tons of that sold in the month before. Consuming interests are active and optimistic, particularly the cable and battery manufacturers. The new Western Electric cable plant at Baltimore is expected to go into commission next month, and will probably take a substantial tonnage of lead without lowering the rate of operation at other consuming centers.

A little spot lead has been offered in

the Middle West in the last day or two for 6.675c., St. Louis, but the tonnage is relatively insignificant. Conditions are not such as to presage any price decline here, even though the London market has weakened in each of the last three days. World production of lead declined again in August, to 160,751 tons, compared with 163,594 in July, 164,002 in June, and 168,631 tons in May, according to the A.B.M.S.

Tin Still Neglected

Consumers continue to buy tin in small amounts only, as they need it, and the price is virtually unchanged, at 45c. today for prompt Straits, with forward about ¾c. higher. A decline of about 2,000 long tons is expected in Straits shipments this month, so some lessening of visible supplies may result, but consumers are utterly complacent about such items.

Silver Slightly Higher and Quiet

During the last week the silver market has been quiet and inactive, and prices fluctuated within narrow limits. As a result of a reversal in China's position and moderate orders from India, prices improved slightly, but the market closes with an uncertain tendency.

Mexican Dollars (Old Mexican pesos): Sept. 19th, 37⅝c.; 20th, 37½c.; 21st and 23d, 37⅜c.; 24th, 37¼c.; 25th, 38⅛c.

Canadian Dollars Weak

Closing cable quotations on the leading Continental exchanges on Tuesday, Sept. 24, follow: Francs, 3.91½c.; lire, 5.23$\frac{15}{16}$c.; and marks, 23.81¾c. Canadian dollars sharply declined to a discount of 1$\frac{7}{16}$ per cent.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

ALUMINUM—Per lb., 99 per cent plus grades, price of leading interest, 24.30c. Outside market, 99 per cent plus, 24.30c.; 98-99 per cent, 23.90c.

ANTIMONY—Per lb., duty paid, New York: Chinese brands 8⅝@8¾c. per lb. for spot and future shipments. Market dull. Cookson's "C" grade, spot, 14c. Market quiet.

BISMUTH—Per lb., New York, in ton lots, $1.70. Smaller lots, $1.80 and up.

CADMIUM — Per lb., New York: 80@90c. Steady demand.

IRIDIUM — Per oz., $220@$230 for 98@99 per cent sponge and powder.

NICKEL—Per lb. ingot, 35c.; shot, 36c.; electrolytic, 35c. (99.9 per cent grade) for single lots of spot metal.

PALLADIUM — Per oz., $36@$38. Small lots bring up to $48. Nominal.

PLATINUM—Official price quoted by the leading interest on small orders for refined metal is $65 per oz. Transactions between dealers and refineries in the outside market are reported at several dollars less.

QUICKSILVER — Per 76-lb. flask, $124@$125. Small lots command the usual premiums.

Prices of Chromium, Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Titanium, Tungsten, Vanadium, and Zirconium are unchanged from the issue of Sept. 7.

Metallic Ores

TUNGSTEN ORE—Per unit of WO_3, N. Y.: Wolframite, $15.25@$15.50 for future shipment. Near-by offerings light and prices are steady. Bolivian scheelite, $15.75 Oct.-Nov. shipment. Western scheelite, $16.50 for Nov.-Dec. shipment.

Antimony, Chrome, Iron, Manganese, Tantalum, Titanium, Vanadium, and Zircon ores are unchanged from quotations in the Sept. 7 issue.

Platteville, Wis., Sept. 21, 1929

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$46.25
Lead Ore	
Lead, basis 80 per cent	$87.50

Shipments for the week: Blende, 676 tons; lead, 80 tons. Shipments for the year: Blende, 25,070; lead, 1,420 tons. Shipments for the week to separating plants, 1,339 tons blende.

Tri-State Flotation Concentrate in Demand

Joplin, Mo., Sept. 1, 1929.

Blende		Per Ton
High		$46.75
Premium blende, basis 60%		44.00
Prime Western, basis 60%	$43.00@	44.00
Table concentrate, 60%	41.00@	43.00
Flotation concentrate, 60%	39.00@	41.00
Average price, all zinc		44.60
Galena		
High		$88.75
Basis 80% lead		87.50
Average settling price, all lead		87.19

The shipment of galena was slightly less than the preceding week. Demand continued strong, but sellers were reluctant to dispose of reserve stocks, doubtless hoping another step-up in the price would occur in October.

Since the retort smelters have adjusted their plants to the economical treatment of flotation zinc concentrates, the demand for fines and slimes produced by table and flotation concentration has steadily increased. This demand now exceeds the supply, and coarse ores, heretofore in prime demand, are stored in reserve. This fact has introduced a controversial problem of concentration, a settlement of which must soon be made.

With the Evans-Wallower Lead Company regularly in the market for a stipulated tonnage of zinc flotation concentrate for the new electrolytic plant at East St. Louis, the acuteness of the demand for this grade is accentuated. Producers are therefore expecting a higher price for their flotation product. Early in 1928 the demand was light for this fine material.

A peak of production was doubtless attained during August at 13,500 tons. It is now apparently diminished to less than 13,000 tons per week.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, and Tripoli are unchanged from prices in the Sept. 7 issue.

Metallic Compounds

ARSENIOUS OXIDE (White Arsenic) Per lb., 4c. Market steady on good contract business from both insecticide and glass manufacturers.

SODIUM NITRATE — Per 100 lb., $2.10 for October deliveries.

Antimony Oxide, Calcium Molybdate, Copper Sulphate, Sodium Sulphate, and Zinc Oxide are unchanged from prices in the Sept. 7 issue.

Alloys

FERROMANGANESE—Per long ton, domestic and foreign, f.o.b. furnace or duty paid, port of entry, $105. Spiegeleisen, 19@21 per cent, $34 f.o.b. furnace on carload business.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent W, $1.45@$1.50, f.o.b. works.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferrovanadium, Nickel Silver, and Yellow (Muntz) Metal are unchanged from prices in the Sept. 7 issue.

Rolled Metals

Effective Sept. 24, base price of sheet zinc raised to 10½c. f.o.b. works. Copper, lead, Monel metal, and nickel sheets, and copper wire, are unchanged from prices in the Sept. 7 issue.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and Zirkite are unchanged from quotations in the issue of Sept. 7.

Iron, Steel, and Coke

IRON—Per gross ton, Valley furnaces, Bessemer, $19; basic, $18.50; No. 2 foundry, $18.50.

STEEL—Base prices per gross ton Pittsburgh, billets and slabs, $35; plates, structural shapes, and soft steel bars, per 100 lb., $1.95.

COKE—Per gross ton, Connellsville furnace, $2.65@$2.75. Connellsville foundry, $3.75@$4.85. Byproduct coke, Ohio and Kentucky (Connellsville basis) $6.50; Buffalo and Detroit, $8.50@$9.

Mining Stocks—Week Ended September 21, 1929

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda Copper	New York	127	122⅛	122⅛	Jl. 13, Au. 19 Q	1.75
Andes Copper	New York	57	54⅛	55	Jl. 13, Au. 12 Q	0.75
Arizona Com	Boston	2⅛	2⅛	2⅛	Jl. 16, Jl. 31 SA	0.25
Calumet & Ariz	New York	129	125⅛	125⅛	Se.6, Se.23 Q	2.50
Calumet & Hecla	Boston	45⅛	43⅛	44⅛	Au.31,Se.30 Q	1.00
Cerro de Pasco	New York	100	95⅛	96	Jl.11, Au. 1 Q	1.50
Con. Coppermines	N. Y. Curb	10⅛	9⅛	9⅛		
Copper Range	Boston	24	22⅛	23⅛	Se.14, Oc.15 Q	0.50
East Butte	Boston	2⅛	2⅛	2⅛	Dec., 1919	0.50
Granby Con	New York	93	85⅛	89	Oc. 18, No.1 Q	2.00
Greene Cananea	New York	188⅛	183	183	Se.12, Oc.7 Q	2.00
Howe Sound	New York	66	63	63	Se.30, Oc 15 Q	1.00
Hudson Bay	N. Y. Curb	18⅛	17⅛	17⅛		
Inspiration	New York	47	43⅛	44	Se 9, Oc 7 Q	1.00
Isle Royale	Boston	22	22	22	Au. 31, Se.30	0.50
Kennecott	New York	89⅛	85⅛	86⅛	Au. 30, Oc. 1 Q	1.25
Magma Copper	New York	72⅛	69⅛	69⅛	Se.30, Oc.15 Q	1.25
Mason Valley	N. Y. Curb	2	2	2		
Miami Copper	New York	44	43	43⅛	Au. 1, Au. 15 Q	1.00
Mohawk	Boston	63	60⅛	62	Jl. 31, Se. 2 Q	2.00
Mother Lode	New York	2⅛	2⅛	2⅛	Je. 13, Je. 29	0.20
Nevada Con	New York	49⅛	46⅛	46⅛	Se. 18, Se. 30 Q	0.75
Noranda	N. Y. Curb	60	56	56⅛		
Ohio Copper	N. Y. Curb	1⅛	1⅛	1⅛	Sept., 1926	0.03
Old Dominion	Boston	9⅛	7⅛	8	Dec., 1918	1.00
Phelps Dodge	New York	66⅛	63	63⅛	Se. 4, Oc.1 Q	0.75
Quincy	Boston	46⅛	44	44	March, 1920	1.00
Roan Antelope	N. Y. Curb	46⅛	43⅛	43⅛		
St. Mary's M. L.	Boston	41	38⅛	41	Fe.25, Mr.12	2.00
Seneca Copper	New York	5⅛	4⅛	4⅛		
Shattuck Denn	N. Y. Curb	15⅛	15	15		
Sherritt-Gordon	Toronto	7.10	6.80	6.90		
Tenn. C. & C.	New York	19⅛	18⅛	18⅛	Au.31, Se.16 Q	0.25
United Verde Ex	N. Y. Curb	17	16⅛	16⅛	Oc. 2, No. 1 Q	1.00
Utah Copper	New York	...	...	325	Se. 18, Se. 30 Q	4.00
Waite-Ack.-Mont.	Toronto	6.00	5.75	6.00		
Walker Mining	Salt Lake	5.90	5.65	5.85		
Wenden Copper	N. Y. Curb	1	1	1		
LEAD, ZINC, SILVER						
Ahumada Lead	New York	1⅛	1⅛	1⅛		
Amer. Z. L. & S.	New York	23⅛	19⅛	19⅛	May, 1917	1.00
A. Z. L. & S., pfd.	New York	100	98⅛	98⅛	Se.19, Oc. 1 Q	1.50
Bunker Hill & S.	N. Y. Curb	...	...	145⅛	Au.22, Se.5 X	0.75
Butte Cop. & Zn.	New York	4⅛	4⅛	4⅛		
Butte Cop. Con.	Boston Curb	*75	*31⅛	*68⅛		
Butte & Sup.	New York	8⅛	7⅛	7⅛	Je. 14, Je. 29 Q	0.50
Callahan Zn-Ld.	New York	2⅛	2⅛	2⅛	Dec., 1920	0.50
Chief Consol.	Salt Lake	3.50	3.40	3.40	Fe. 1, 1928 K	0.10
Consol. Ld. & Zn. "A"	St. Louis	11	10	10	Se.20, Oc.1 Q	0.25
Constitution	Spokane	*53⅛	*47⅛	*53⅛		
Dayrock	Spokane	3.25	3.00	3.00	Je.20, Je.30	0.03
Dickens Consol.	Spokane	*7⅛	*7	*7⅛		
Eagle-Picher	Cincinnati	17	16⅛	16⅛	Je. 30, Jl.15 Q	0.20
Eagle-Pich., pfd.	Cincinnati	...	...	103	Je. 30, Jl. 15 Q	1.50
Erupcion	Boston Curb			*12	Ja. 1, 1928 Q	0.07½
Eureka Bullion	Salt Lake	*99	*94	*99		
Evans-Wallower	N. Y. Curb	18⅛	16⅛	17⅛		
Evans-Wal., pfd.	N. Y. Curb	...	...	79⅛	Je.20, Jl. 1 Q	1.75
Federal M. & S.	New York	245	245	245	Je., 1927	10.00
Fed. M. & S., pfd.	New York	...	...	99⅛	Au.23, Se.16 Q	1.75
Gladstone	Spokane	*5	*4	*4⅛		
Goldconda	Spokane	*89	*76⅛	*89	Je.15, Jl.1	0.02
Grandview	Spokane	*30⅛	*28⅛	*29⅛		
Hecla Mining	N. Y. Curb	17	16⅛	17	Au.15,Se.15 Q	0.25
Highland-Surprise	Spokane	*14⅛	*12⅛	*14⅛		
Jack Waite	Spokane	*15	*8⅛	*15		
Kootenay Florence	Spokane	*12⅛	*12	*12⅛		
Lucky Jim	Spokane	*12	*9	*12		
Lucky Tiger-C.	Kansas City	†3.00	†2.87½	....	Se. 10, Se. 20	0.02½
Mexican Premier	Spokane	2.38	2.25	2.27		
National Lead	New York	194⅛	183	183	Se.13, Se.30 Q	1.25
Natl. Lead, pfd. A	New York	140	139	140	Au.30, Se.14 Q	1.75
Natl. Lead, pfd. B	New York	116⅛	116	116	Oc. 18, No. 1 Q	1.50
N. J. Zinc, new	N. Y. Curb	87⅛	84	86⅛	Jl.20, Au.10 Q	0.50
New Quincy	Salt Lake	2.22½	2.10	2.20	Se.20, Se 29 Q	0.10
Noble Five	Spokane	*58	*54	*58		
North Lily	Salt Lake	6.00	5.10	5.50	Jl.16, Jl.20 Q	0.25
Park Bingham	Salt Lake	6.50	6.00	6.00		
Park Utah	New York	4⅛	4⅛	4⅛	Dividends suspended	
Pend Oreille	Spokane	5.00	4.50	4.50		
Rico Argentine	Salt Lake	...	...	*32	No. 30, De. 15 Q	0.03
Ruth-Hope	Spokane	*37	*34	*36⅛		
St. Joseph Lead	New York	70⅛	66⅛	67	Se.10,Se.20 QX	0.75
Sherman Lead	Spokane	*67⅛	*63	*63		
Silver King Coa.	Salt Lake	12.87½	12.50	12.50	Se. 20, Oc. 1 Q	0.25
Silversmith	Spokane	*7⅛	*7⅛	*7⅛	Oct., 1926 Q	0.02
Sunshine Mining	Spokane	6.00	6.00	6.00	Se. 10, Se. 20 Q	0.05
Tamarack-Custer	Spokane	*66	*50	*55	Sept., 1924	0.25
Tintic Standard	Salt Lake	12.87½	12.87½	12.87½	Se. 17, Se.20 X	0.30⅛
Tonopah Belmont	N. Y. Curb	*62½	*50	*50	Oct., 1925	0.05
Treadwell-Yukon	Toronto	9.25	9.50	9.00		
United Zinc Smg.	N. Y. Curb	...	...	*68⅛		
Utah Apex	Boston	3⅛	3⅛	3⅛	May 15, June 1	0.25
Utah Met. & Tun.	Boston	1⅛	1	1	Dec., 1917	0.30
Whitewater	Spokane	*48	*40	*40		
Yellow Pine	Los Angeles	...	....	*8	Dec., 1925 QX	0.04
GOLD						
Alaska Juneau	New York	8⅛	7⅛	7⅛		
Barry-Hollinger	Toronto	*24	*20	*20⅛		
Central Manitoba	Toronto	*35	*31	*32		
Cresson Consol.	N. Y. Curb	*50	*43⅛	*50	Se.30, Oc.10 Q	0.02
Dome Mines	New York	9⅛	9⅛	9⅛	Se. 30, Oc.21 Q	0.25
Golden Cycle	Col. Springs	†1.75	†1.60	....	Au 31,Se.10 Q	0.04
Hollinger	Toronto	5.90	5.75	5.90	Se.20, Oc.7 FW	0.50
Homestake	New York	88	85	88	Au.20, Au.26 H	0.50⅛
Kirkland Lake	Toronto.	*59	*47	*52		
Lake Shore	Toronto	23.50	22.00	22.10	Je.1, Je.15 Q	0.20
McIntyre Porcupine	New York	14	14	14	Au.1, Se.2 Q	0.25
Portland	Colo.Springs	†*6	†*4⅛	....	April, 1927	0.02
Rand Mines	New York	...	...	35⅛	Au. 21,'29 Am.Sh.	1.51
Siscoe	Toronto	1.30	*88	*96		
Sylvanite	Toronto	*80	*76	*80		
Teck-Hughes	Toronto	6.25	5.70	5.80	Jl. 18, Au. 1	0.15
Tom Reed	Los Angeles	*62	*60	*62	Dec., 1926	0.02
Unity Gold	N. Y. Curb	1⅛	1	1⅛		
Vipond Consol.	Toronto	*78	*72	*74	April, 1927	0.03
Wright-Hargreaves	Toronto	1.59	1.50	1.55	Oc. 16, No. 1	0.02½
Yukon-Alaska	N. Y. Curb	....	....	35⅛		
GOLD AND SILVER						
Carnegie Metals	N. Y. Curb	17⅛	16⅛	17		
Castle-Trethewey	Toronto	*30	*30	*30		
Consol. Cortes	N. Y. Curb	12⅛	*6⅛	*12⅛		
Dolores Esperanza	N. Y. Curb	*50	*37⅛	*37⅛	July, 1923	0.05
Keeley	Toronto	*45	*45	*45	Mr.15, 1928	0.04
Mining Corp.	Toronto	4.20	4.05	4.15	My.30, Je.13	0.12½
Montana-Mines Corp.	Spokane	†*47	†*45⅛	....		
N. Y. & Hond. Ros.	N. Y. Curb	...	...	16	Jl.17, J l.27 QX	0.50
Nipissing	N. Y. Curb	2⅛	2⅛	2⅛	Se 26, Oc.21 Q	0.07½
Premier Gold	N. Y. Curb	1⅛	1⅛	1⅛	Se.12, Oc.3 Q	0.06
Tonopah Exten.	N. Y. Curb	...	...	*10	April, 1925	0.05
Tonopah Mining	N. Y. Curb	3⅛	3⅛	3⅛	Ap. 7, Ap. 20	0.07½
United Eastern	N. Y. Curb	*25	*25	*25		
Yukon Gold	N. Y. Curb	*81⅛	*75	*81⅛	June, 1918	0.02
IRON AND STEEL						
Bethlehem Steel	New York	131⅛	121⅛	122⅛	Oc. 18, No. 15 Q	1.50
Beth. Steel, pfd, 7%.	New York	128	125	126	Se.6, Oc.1 Q	1.75
Cleveland-Cliffs	Cleveland	97	96⅛	96⅛	Se. 5, Se.15 Q	1.00
Colo. Fuel & Iron	New York	64⅛	59⅛	62		
Colo. F. & I., 1st pfd.	New York	137⅛	137⅛	137⅛	Au.10, Se.26, Q	2.00
Great Northern Iron.	New York	31⅛	30	30⅛	Dec.15, K	2.00
Inland Steel	New York	102	99⅛	100	Au.15, Se. 1, Q	1.87½
Republic I. & S.	New York	146⅛	136⅛	139⅛	My. 11, Je. 1, Q	1.00
Republic I. & S., pfd.	New York	112	112	112	Je .12, Jl. 1, Q	1.75
Sloss-Sheffield S. & I.	New York	...	...	63	Mr. 11, Mr.20, Q	1.50
Sloss-Sheff. S. & I., pfd.	New York			74⅛	Se.20, Oc.1, Q	1.50
U. S. Steel	New York	247⅛	230⅛	232⅛	Au. 29, Se. 28, Q	1.75
U. S. Steel, pfd.	New York	143⅛	142	143⅛	Au. 5, Au. 30, Q	1.75
Virginia I. C. & C.	New York	...	...	20	Jan., 1924	1.50
Virginia I.C.& C., pfd.	New York	...	...	43	Jl.16, 1928 SA	2.50
MISCELLANEOUS						
Aluminum Co. of Am.	N. Y. Curb	460	435	449		
Alum.Co.of Amer., pf.	N. Y. Curb	108⅛	107⅛	107⅛	Mr.15, Ap.1, Q	1.50
American Metal	New York	76⅛	73⅛	75⅛	Au. 21, Se. 1 Q	0.75
Amer. Metal, pfd., 6%	New York	127⅛	127⅛	127⅛	Au. 21, Se. 3 Q	1.50
Amer. Sm. & Ref.	New York	123⅛	118⅛	118⅛	Je. 30, Jl. 12 Q	1.00
Amer. Sm. & Ref., pfd.	New York	135⅛	135	135⅛	Au. 3, Se. 1 Q	1.75
Ang. Ch. Nitrate	N. Y. Curb	39	36⅛	36⅛		
Asbestos Corp.	Montreal	7	6	7	Jan. 1926	1.50
Asbestos Corp., pfd.	Montreal	20	20	20	De. 31, Ja. 15 Q	1.75
Consol. M. & S.	Montreal	410	409⅛	410	Je.29,Jl.15, SA	X6.25
De Beers Consol.	New York	21	21	21	Jl. 23, Jl.26, Q	0.96
Federated Metals	N. Y. Curb	38⅛	36⅛	37⅛	Oc.3, Oct. 11 Q	0.25
Freeport Texas	New York	48⅛	45	47⅛	Oc. 15, No 1 Q	1.00
Int. Nickel Can.	New York	60⅛	56⅛	57⅛	Au.31, Se.30 Q	0.25
Int. Nickel, pfd.	New York	...	...	122⅛	Se.28, No.1 Q	1.75
Mayflower Assoc.	N. Y. Curb	101	95⅛	101		
Metal & Mining	N. Y. Curb	19⅛	19⅛	19⅛	Se.21, Oc.1	0.30
Newmont	N. Y. Curb	234⅛	221	224	Se.30, Oc.15 Q	1.00
Patiño M. & E.	New York	40⅛	38⅛	38⅛	Au.31,Se.28,Am.Sh.	0.97
So. America G. & P.	N. Y. Curb	...	...	2		
Texas Gulf Sulphur	New York	73⅛	68⅛	71⅛	Se.2, Se.16 Q	1.00
U. S. Sm. R. & M.	New York	53⅛	51	51	Jl. 5, Jl. 15 Q	0.87½
U. S. Sm. R. & M., pfd.	New York	54	54	54	Jl. 5, Jl. 15 Q	0.87½
Vanadium Corp.	New York	97⅛	92	94	Au,1 Au. 15 Q	0.75

Toronto Standard Stock Exchange, Toronto, courtesy the Arthur E. Moysey Co.; Salt Lake Stock Exchange, courtesy J. A. Hogle & Co. and Logan & Bryan, New York; Standard Stock Exchange, Spokane, courtesy Pohlman Investment Company.

*Cents per share. †Bid or asked. Q. Quarterly. A. Annually. SA, Semi-annually. M, Monthly. BM, Bimonthly. FW, Four weeks. K, Irregular. I, Initial. R, Resumption. X, Extra. The first date given is that of the closing of the books: the second that of the payment of the dividend.

LONDON QUOTATIONS—WEEK ENDED September 19, 1929

	High	Low	Last	Date	Amount
Alaska Mexican ($5)	20/—	20/—	20/—		
Alaska Treadwell (25)	55/—	55/—	55/—	Nov., 1926	4 p.c.
Aramayo Mines (25 frs.)	59/3	57/6	57/6	Aug., 1929	5 p.c.
Burma Corp (10 rupees)	18/4½	17/9	18/—	July 1929	9 annas*
Bwana M'Kubwa (5s)	35/10½	31/3	33/4½		
Camp Bird (2s)	3/1½	2/7½	2/9	April, 1928	16⅔ p.c.
El Oro (5s)	3/1½	2/9	3/—	Nov., 1924	2½ p.c.*
Frontino & Bolivia (£1)	6/10½	6/10	6/10½	Jan., 1929	3½ p.c. (e)
Mexican Corpn. (£1)	17/10½	16/—	17/6		
Mexico Mines of El Oro (£1)	7/6	6/6	6/6	Dec., 1926	3½ p.c.*
Mount Isa (£1)	41/3	39/3	40/—		
N'Changa Copper Mining. (£1)	76/10½	68/9	75/—		
Oroville Dredging (4s)	1/10½	1/10½	1/10½	Nov., 1928	31½ p.c
Rhodesian Congo Border (£1)	213/9	197/6	200/—		
St. John del Rey (£1)	15/10½	15/6	15/6	Apr., 1929	7½ p.c.
San Francisco Mines (10s)	35/6	35/—	35/3	June 1929	15 p.c.
Santa Gertrudis (£1)	10/—	9/1½	10/—	July 1929	7½ p.c.
Selukwe (2s. 6d.)	5/10½	5/1½	5/9	April, 1917	6¼ p.c.
S. Amer. Copper (2s.)	3/—	2/9	2/10½	Nov. 1917	75 p.c.
Tanganyika (£1)	64/9	61/9	63/1½	July, 1929	5 p.c.
Union Miniere du Haut-Katanga (Brussels)	11,975	11,725	11,935	April, 1929	300 fr.(‡)

*Free of British income tax. †Swiss francs and plus 15 p. c. bonus. ‡Belgian francs and free of taxation. (d) U. S. Dollars. (e) July, 1929, ex ½d. return of capital. (e) on original £1 shares.